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INTRODUCTION

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The National Aeronautics and Space Administration makes the results of worldwide research and development activities in aeronautics, space, and supporting disciplines promptly available to participants in its programs. NASA's scientific and technical information system now contains nearly a million documents, which are abstracted, indexed, and obtainable through retrieval and dissemination services. These services, which include this abstract journal, *Scientific and Technical Aerospace Reports (STAR)*, are described in a bulletin, *The NASA Scientific and Technical Information System . . . and How to Use It*, available at no charge from the NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Maryland 20740.

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Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

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By arrangement between NASA and the American Institute of Aeronautics and Astronautics, the AIAA publication *International Aerospace Abstracts (IAA)* provides parallel coverage of scientific and trade journals, books, and conference papers in the same subject areas as *STAR*. *STAR* and *IAA* are categorized and abstracted in basically identical ways, and documents in both are indexed by terms from the *NASA Thesaurus*. Both journals appear twice monthly, *IAA* being issued on the 1st and 15th of each month.

IAA is available on subscription from the American Institute of Aeronautics and Astronautics. Technical Information Service, 750 Third Avenue, New York, N.Y. 10017, at the following annual rates:

Semimonthly issues: United States and possessions, $110 postpaid; foreign countries, $125 postpaid.

Cumulated index volumes: United States and possessions, $75 postpaid; foreign countries, $90 postpaid.

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Scientific and technical reports produced by NASA and its contractors and grantees, or in conjunction with other Government agencies, and other selected documents released by NASA are identified by an asterisk (*) following the accession numbers (e.g., N72-10748*). Prior to their announcement in *STAR*, these NASA publications are assigned a specific NASA report number, which is shown on the last line of the *STAR* citation. The nature of NASA publications is specified by the report number series, identified by a prefix to the report number: TR-R, TN-D, TM-X, TT-F, CR, or SP. These series refer respectively to NASA Technical Reports, which contain significant and complete contributions to scientific and technical knowledge; Technical Notes, reports of similar quality by lesser scope; Technical Memorandums, reports containing preliminary data or of specialized utility; Technical Translations, information published in a foreign language and considered to merit NASA distribution in English; Contractor Reports, information generated under NASA-sponsored contracts, grants, or interagency agreements; and Special Publications, which include conference proceedings, monographs, data compilations, sourcebooks, special bibliographies, and other publications derived from or of value to NASA activities. Reports in these series that are printed by NASA are often referred to as "low numbered" or "low series" publications, because the report number is always below 50,000 (8,000 for Technical Translations). Some TM-X and CR reports are numbered above 50,000. These, and TT-F translations above 8,000, are referred to as "high-numbered" or "high series" publications, and are generally available only in microfiche[1] or facsimile reproductions.

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA Thesaurus* should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: heirarchical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

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Federal Republic of Germany

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02 Aircraft 2234
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 2239
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 2240
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 2245
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 2247
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 2249
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

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08 Computers 2255
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 2257
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 2259
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 2262
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 2263
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 2269
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14 Instrumentation and Photography 2279
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 2284
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

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18 Materials, Nonmetallic 2296
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 2298
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 2299
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 2302
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 2304
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

23 Physics, General 2306
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Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

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28 Propulsion Systems 2324
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29 Space Radiation 2327
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 2328
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 2339
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 2344
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 2364
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

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TYPICAL CITATIONS AND ABSTRACTS

NASA CONTRACTOR REPORT CITATION AND ABSTRACT

NASA SPONSORED DOCUMENT

NASA ACCESSION NUMBER

TITLE

AUTHORS

CONTRACT OR GRANT

REPORT NUMBERS

N72-10043 # Boeing Co., Wichita, Kans.
STUDY AND DEVELOPMENT OF ACOUSTIC TREATMENT FOR JET ENGINE TAILPIPES
M. D. Nelson, L. L. Linscheid, B. A. Dinwiddie, III, and O. J. Hall, Jr. Washington NASA Nov. 1971 66 p refs
(Contract NAS1-9622)
(NASA-CR-1853; D3-8535) Avail: NTIS CSCL 01B

A study and development program was accomplished to attenuate turbine noise generated in the JT3D turbofan engine. Analytical studies were used to design an acoustic liner for the tailpipe. Engine ground tests defined the tailpipe environmental factors and laboratory tests were used to support the analytical studies. Furnace-brazed, stainless steel, perforated sheet acoustic liners were designed, fabricated, installed, and ground tested in the tailpipe of a JT3D engine. Test results showed the turbine tones were suppressed below the level of the jet exhaust for most far field polar angles. Author

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PUBLICATION DATE

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PATENT CITATION

N72-12440* Auburn Research Foundation, Inc., Ala.
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA) Issued 13 Jul. 1971 14 p Filed 2 Oct. 1969 Supersedes N70-22250 (08-09, p 1645
(NASA-Case-MFS-20180; US-Patent-3,593,194; US-Patent-Appl-SN-863276; US-Patent-Class-331-94.5; US-Patent-Class-350-1; US-Patent-Class-350-312) Avail: US Patent Office CSCL 20E

NASA CASE NO.

U.S. PATENT CLASS NUMBERS

U.S. PATENT NO.

PATENT APPLICATION CITATION

N72-10432*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC INFRARED GASDYNAMIC LASER Patent Application
Robert L. McKenzie, inventor (to NASA) Filed 26 Apr. 1971 14 p
(NASA-Case-ARC-10370-1; US-Patent-Appl-SN-137391) Avail: NTIS CSCL 20E

U.S. PATENT APPLICATION SERIAL NO.

PRIMARY ANALYTIC CITATION AND ABSTRACT

PLACE OF PUBLICATION

N72-10856*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE GEMINI PROGRAM: PHYSICAL SCIENCES EXPERIMENTS SUMMARY
Edward O. Zeitler, comp. and Thomas G. Rogers, comp. (ITT Federal Electric Corp. Houston, Tex.) Sep. 1971 554 p refs
(NASA-TM-X-58075) Avail: NTIS HC $6.00/MF $0.95 CSCL 22C

Results and findings of physical sciences experiments performed in the Gemini program are presented. The summary contains descriptions of selected studies in the fields of astronomy, navigation, radiation, geophysics, meteorology, photography, and communications. For individual titles, see N72-10857 through N72-10891.

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N72-25992*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 16
Mar. 1972 131 p refs
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This special bibliography lists 426 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1972. Author

N72-25993*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 17
Apr. 1972 129 p refs
(NASA-SP-7037(17)) Avail: NTIS HC $3.00 CSCL 01A

This special bibliography lists 409 reports, articles, and other documents introduced into NASA scientific and technical information system in March 1972. Author

N72-25994 Connecticut Univ., Storrs.
PASSAGE OF AN AIRFOIL THROUGH A THREE-DIMENSIONAL DISTURBANCE Ph.D. Thesis
John Joseph Adamczyk 1971 114 p
Avail: Univ. Microfilms Order No. 71-29839

An analysis was undertaken to determine an explicit expression for the pressure field generated by the passage of a three dimensional disturbance over an airfoil. This work was based on an extension of the formulation to solve the problem of an isolated airfoil oscillating in a compressible fluid. The present analysis was applied to the problem of determining the pressure field generated by the passage of an acoustical wave, viscous wakes, and a turbulent flow over an airfoil. Dissert. Abstr.

N72-25995 Virginia Polytechnic Inst., Blacksburg.
THE AEROELASTIC STABILITY OF SPINNING, UNGUIDED LAUNCH VEHICLES Ph.D. Thesis
Clarence Painter Young, Jr. 1971 98 p
Avail: Univ. Microfilms Order No. 71-31035

The aeroelastic stability of spinning, unguided launch vehicles is explored. The equations of motion that characterize aeroelastic behavior are derived and presented in detail. The mathematical character of aeroelastic stability solutions of the governing equations is revealed and the theory is applied to a typical launch vehicle configuration. Detailed input data for the analysis are provided along with the analytical results. The analysis reveals how the aeroelastic stability characteristics for the spinning vehicle differ from those of the nonspinning vehicle. Also, results of extensive studies are given to illustrate the effects of aerodynamic asymmetry and Magnus forces on the stability boundaries. The analysis reveals that classical aeroelastic divergence can occur for the asymmetric vehicle, with or without Magnus effects, within certain spin rate contours. Outside of these contours, dynamic instabilities can occur which restrict the values of spin rate and dynamic pressure for stable flight. Magnus effects are found to be destabilizing in all numerical applications of the theory for both the symmetric and asymmetric vehicle analysis. Dissert. Abstr.

N72-25996*# Wichita State Univ., Kans. Dept. of Aeronautical Engineering.
EFFECTS OF LEADING-EDGE CAMBER ON LOW-SPEED CHARACTERISTICS OF SLENDER DELTA WINGS: TECHNIQUES AND TABULATED DATA
W. H. Wentz [1972] 346 p refs
(Contract NAS1-10082)
(NASA-CR-112016) Avail: NTIS HC $19.50 CSCL 01A

Special tests to determine the importance of transition fixing and Reynolds number variation on forces produced by thin delta wings are discussed. Transition fixing was achieved by applying cement to models and sprinkling grit on wet adhesive. Strips were applied along lines emanating from the apex located along sixty-five percent semi-span rays. Tests were made with grit on both surfaces, upper surface only, lower surface only, and on clean surfaces. Reynolds number varied by testing at three dynamic pressures. Correspondence between dynamic pressure and Reynolds number based on the mean aerodynamic chord are shown. No significant changes are noted due to either Reynolds number variation or transition fixing, within the range of Reynolds numbers used for the test. Author

N72-25997*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS OF A 60 DEGREE SWEPT DELTA-WING SPACE SHUTTLE ORBITER AT MACH NUMBERS OF 2.50, 3.90, AND 4.60
Ernald B. Graves Washington May 1972 116 p
(NASA-TM-X-2561; L-8243) Avail: NTIS HC $3.00 CSCL 22B

Wind tunnel tests were performed to determine the static aerodynamic characteristics of a model of a 60 degree swept delta wing space shuttle orbiter. Some control effectiveness tests were included. The tests were conducted in a unitary plan wind tunnel at Mach numbers of 2.50, 3.90, and 4.60. Author

N72-25998*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL INVESTIGATION OF STABILITY AND STALL FLUTTER OF A FREE-FLOATING WING V/STOL MODEL
Robert A. Ormiston Washington Jun. 1972 45 p refs
Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TN-D-6831; A-4088) Avail: NTIS HC $3.00 CSCL 01A

An experimental investigation was made of the static and dynamic stability characteristics of a one-fourth scale model of a tilt-propeller free-wing V/STOL aircraft. The effects of wing pivot location, wing chord, trailing-edge angle, propeller tilt angle, and thrust were studied, and a limited evaluation was made of high-lift devices. A dynamically similar wing was used to measure frequency and damping ratio from transient response data in the linear aerodynamic regime and the results were compared to quasi-steady and unsteady aerodynamic theory. It was found that at high trim angles of attack, in the nonlinear aerodynamic regime, stall flutter oscillations occurred with typical amplitudes ranging from 15 to 20 deg. Wing control tab deflection was effective in initiating and terminating stall flutter but variations in configuration or operating conditions did not greatly influence the occurrence of characteristics of the oscillations. Author

N72-25999*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL STATIC AERODYNAMICS OF A REGULAR HEXAGONAL PRISM IN A LOW DENSITY HYPERVELOCITY FLOW
Robert W. Guy, James N. Mueller, and Louise P. Lee Washington Jun. 1972 61 p refs
(NASA-TN-D-6816; L-8229) Avail: NTIS HC $3.00 CSCL 01A

A regular hexagonal prism, having a fineness ratio of 1.67, has been tested in a wind tunnel to determine its static aerodynamic characteristics in a low-density hypervelocity flow. The prism tested was a 1/4-scale model of the graphite heat shield which houses the radioactive fuel for the Viking spacecraft auxiliary power supply. The basic hexagonal prism was also modified to simulate a prism on which ablation of one of the six side flats had occurred. This modified hexagonal prism was tested to determine the effects on the aerodynamic characteristics of a shape change caused by ablation during a possible side-on stable reentry. Author

N72-26000*# Translation Consultants, Ltd., Arlington, Va.
SIMULATION OF AN INCREASED REYNOLDS NUMBER PRODUCED BY ROUGHNESS ON AN AIRCRAFT MODEL IN TRANSONIC RANGE
X. Vaucheret Washington NASA Jun. 1972 25 p refs
Transl. into ENGLISH from Rech. Aerospatiale (Paris), no. 6, Nov. - Dec. 1971 p 335-346 and from rept. ONERA-TP-1070 dated 1971
(Contract NASw-2038)
(NASA-TT-F-14290) Avail: NTIS HC $3.25 CSCL 01A

A high level of Reynolds number simulation for obtaining in a wind tunnel the aerodynamic characteristics of a transport aircraft in the transonic range is discussed. Simulating an increased Reynolds number with roughness set on an aircraft model is an inexpensive way to make use of existing wind tunnels. Sticking near the leading edge glass balls or chordwise threads, at a rather broad pitch, provides the most efficient roughness. The influence of this roughness on the shock-boundary layer interaction pattern contributes to increase the lift gradient and to carry rearwards the neutral point. The parietal visualization technique using fluid paints, of which a few examples are shown in color, is a practical means for investigating flow separation. This method helps to understand the working of roughness. Author

N72-26001# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
CALCULATION OF PRESSURE DISTRIBUTIONS FOR AN AIRFOIL IN SUBCRITICAL FLOW INCLUDING THE EFFECT OF THE BOUNDARY LAYER
S. Anders, L. Gustavsson, Robert S. Hillgren, and Goeran I. Toll 1971 26 p refs
(FFA-AU-901) Avail: NTIS HC $3.50

An approximate method for calculating the pressure distribution on a thick cambered airfoil in subcritical viscous flow is presented. The method calculates the inviscid potential solution for a contour consisting of the airfoil, the associated boundary layer and the wake displacement surfaces, by means of successive iterations. The method is programmed on a digital computer and the results obtained show good agreement with experimental results for low subcritical Mach numbers. For higher subcritical Mach numbers the approximate compressibility correction is not sufficiently accurate. However if the difference between the exact and the approximate inviscid theoretical results is used to correct the approximate results for viscous flow a significantly better agreement with experimental results is obtained. Author

N72-26002*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALCULATION OF LINEARIZED SUPERSONIC FLOW OVER SLENDER CONES OF ARBITRARY CROSS SECTION
Vincent R. Mascitti Washington Jul. 1972 39 p refs
(NASA-TN-D-6818; L-8192) Avail: NTIS HC $3.00 CSCL 01A

Supersonic linearized conical-flow theory is used to determine the flow over slender pointed cones having horizontal and vertical planes of symmetry. The geometry of the cone cross sections and surface velocities are expanded in Fourier series. The symmetry condition permits the uncoupling of lifting and nonlifting solutions. The present method reduces to Ward's theory for flow over a cone of elliptic cross section. Results are also presented for other shapes. Results by this method diverge for cross-sectional shapes where the maximum thickness is large compared with the minimum thickness. However, even for these slender-body shapes, lower order solutions are good approximations to the complete solution. Author

N72-26003# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AEROFOIL STALL PREDICTION IN INCOMPRESSIBLE FLOW
Michel VincentdePaul 1972 16 p refs In FRENCH; ENGLISH summary
(ONERA-TP-1088) Avail: NTIS HC $3.00

A method is proposed to calculate the small separation zones which are initiated near the leading edge of an airfoil at incidence. This calculation analyzes the details of the separation process and predicts the maximum lift that may be obtained within a certain Reynolds number range. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N72-26004*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXTRAPOLATION OF SONIC BOOM PRESSURE SIGNATURES BY THE WAVEFORM PARAMETER METHOD
Charles L. Thomas Washington Jun. 1972 35 p refs

(NASA-TN-D-6832; A-4232) Avail: NTIS HC $3.75 CSCL 01B

The waveform parameter method of sonic boom extrapolation is derived and shown to be equivalent to the F-function method. A computer program based on the waveform parameter method is presented and discussed, with a sample case demonstrating program input and output. Author

N72-26005*# North Carolina State Univ., Raleigh.
RIDING AND HANDLING QUALITIES OF LIGHT AIRCRAFT: A REVIEW AND ANALYSIS
Frederick O. Smetana, Delbert C. Summery, and W. Donald Johnson Washington NASA Mar. 1972 411 p refs
(Contract NAS1-9603)
(NASA-CR-1975) Avail: NTIS HC $6.00 CSCL 01B

Design procedures and supporting data necessary for configuring light aircraft to obtain desired responses to pilot commands and gusts are presented. The procedures employ specializations of modern military and jet transport practice where these provide an improvement over earlier practice. General criteria for riding and handling qualities are discussed in terms of the airframe dynamics. Methods available in the literature for calculating the coefficients required for a linearized analysis of the airframe dynamics are reviewed in detail. The review also treats the relation of spin and stall to airframe geometry. Root locus analysis is used to indicate the sensitivity of airframe dynamics to variations in individual stability derivatives and to variations in geometric parameters. Computer programs are given for finding the frequencies, damping ratios, and time constants of all rigid body modes and for generating time histories of aircraft motions in response to control inputs. Appendices are included presenting the derivation of the linearized equations of motion; the stability derivatives; the transfer functions; approximate solutions for the frequency, damping ratio, and time constants; an indication of methods to be used when linear analysis is inadequate; sample calculations; and an explanation of the use of root locus diagrams and Bode plots. Author

N72-26006*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF LIGHT, TWIN-ENGINE, PROPELLER-DRIVEN AIRPLANES
Chester H. Wolowicz and Roxanah B. Yancey Washington Jun. 1972 371 p refs
(NASA-TN-D-6800; H-646) Avail: NTIS HC $3.00 CSCL 01B

Representative state-of-the-art analytical procedures and design data for predicting the longitudinal static and dynamic stability and control characteristics of light, propeller-driven airplanes are presented. Procedures for predicting drag characteristics are also included. The procedures are applied to a twin-engine, propeller-driven airplane in the clean configuration from zero lift to stall conditions. The calculated characteristics are compared with wind-tunnel and flight data. Included in the comparisons are level-flight trim characteristics, period and damping of the short-period oscillatory mode, and windup-turn characteristics. All calculations are documented. Author

N72-26007*# Boeing Co., Seattle, Wash.
STUDY OF THE APPLICATION OF ADVANCED TECHNOLOGIES TO LONG RANGE TRANSPORT AIRCRAFT. VOLUME 2: ADVANCED TECHNOLOGY PROGRAM RECOMMENDATIONS Final Report
May 1972 245 p refs
(Contract NAS1-10703)
(NASA-CR-112093) Avail: NTIS HC $14.25 CSCL 01B

The benefits of the application of advanced technology to future transport aircraft were investigated. The noise reduction goals established by the CARD (Civil Aviation Research and Development) study for the 1981-1985 time period can be satisfied. Reduced terminal area and airway congestion can result from use of advanced on-board systems and operating procedures. The use of advanced structural design concepts can result in greatly reduced gross weight and improved operating economics. The full potential of these benefits can be realized in a 1985 airplane by implementing a research and development program that is funded to an average level of approximately $55 million per year over a ten year period. Author

N72-26008*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ASPECTS OF INVESTIGATING STOL NOISE USING LARGE SCALE WIND TUNNEL MODELS
Michael D. Falarski, David G. Koenig, and Paul T. Soderman Jun. 1972 35 p refs Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.
(NASA-TM-X-62164) Avail: NTIS HC $3.75 CSCL 01B

The applicability of the NASA Ames 40- by 80-ft wind tunnel for acoustic research on STOL concepts has been investigated. The acoustic characteristics of the wind tunnel test section has been studied with calibrated acoustic sources. Acoustic characteristics of several large-scale STOL models have been studied both in the free-field and wind tunnel acoustic environments. The results indicate that the acoustic characteristics of large-scale STOL models can be measured in the wind tunnel if the test section acoustic environment and model acoustic similitude are taken into consideration. The reverberant field of the test section must be determined with an acoustically similar noise source. Directional microphone and extrapolation of near-field data to far-field are some of the techniques being explored as possible solutions to the directivity loss in a reverberant field. The model sound pressure levels must be of sufficient magnitude to be discernable from the wind tunnel background noise. Author

N72-26009*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TRANSONIC TRANSPORT STUDY, SUMMARY
Louis J. Williams May 1972 46 p refs
(NASA-TM-X-62156) Avail: NTIS HC $4.50 CSCL 01B

The effects of possible increases in cruise speed over present-day transport aircraft were investigated. Increased cruise speed is desirable not only because of a possible competitive market advantage, but also because of the resulting increase in aircraft productivity. Aircraft designed to cruise at Mach numbers greater than those of present-day transports but less than those which produce a sonic boom on the ground were studied. The purpose of the study was three-fold: (1) to compare, on an equal basis, the performance and economics of advanced commercial transport aircraft designed to cruise at Mach numbers 0.90, 0.98, and 1.15; (2) to determine the sensitive technical areas affecting the performance and economics of the aircraft; and (3) to assess the impact of advanced technology, particularly the supercritical wing and advanced composite materials on the performance and economics of the aircraft. Author

N72-26010*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FEASIBILITY STUDY OF A BIDIRECTIONAL JET FLAP DEVICE FOR APPLICATION TO HELICOPTER ROTOR BLADES. PHASE 2: LIFT CONTROLLER DEVELOPMENT
Raymond E. Rose, Tom M. Wynn, Gary A. Smith, and Glen L. Merrill Apr. 1972 111 p refs Prepared by Honeywell, Inc., St. Paul, Minn. and Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.
(Contract NAS2-4389)
(NASA-TM-X-62152) Avail: NTIS HC $7.75 CSCL 01B

A bidirectional jet flap device called the variable deflection thruster (VDT) has been investigated for possible application to helicopter rotors. This investigation included the development and testing of a fluidic lift control system for the VDT-blade model making use of the test result that VDT-blade lift can be sensed from the differential pressure at midchord. This study constitutes a long-range program to develop blown control techniques for stabilizing the higher harmonic modes of helicopter rotors. Wind tunnel tests were conducted using a three-sectioned, two-dimensional VDT-blade model having individually controlled VDT jet flaps in each section. Steady-state tests were conducted without the fluidic lift controller (open loop) for both full-span blowing and for the model center section blowing only. Steady-state tests were conducted with the center section blowing only using the fluidic lift controller (close-loop) to control the lift on the model center section. Dynamic tests were conducted using the complete model with the VDT jet in the model center section oscillating at various frequencies and also using the model center section alone on a single endplate to obtain finite-aspect-ratio effects. Fair agreement was obtained between theory and experimental results. Author

N72-26011# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
SPECIAL STUDY: EMERGENCY LANDING TECHNIQUES IN SMALL FIXED-WING AIRCRAFT
Gerald M. Bruggink 5 Apr. 1972 14 p refs
(NTSB-AAS-72-3) Avail: NTIS HC $3.00

Techniques to increase survivability and reduce injuries in forced and precautionary landings in small fixed-wing aircraft are presented. The study stresses the importance of reducing the main injury-producing factor, deceleration forces, and how to use the aircraft and terrain for this purpose. It describes emergency landing techniques for various flight and terrain conditions. Author

N72-26012# Aeronautical Research Labs., Melbourne (Australia).
RESONANCE TESTS ON A JINDIVIK MK. 3B AIRCRAFT
C. M. Bailey Nov. 1971 30 p
(ARL/SM-371) Avail: NTIS HC $3.50

Resonance tests have been made on a Jindivik mark 3B target aircraft fitted with mark 7 wing tip pods. Multipoint excitation was employed with the use of four electromagnetic vibrators. The natural frequencies and modal shapes of four major wing modes, under each of two loading conditions, in the frequency range up to 40 hertz were measured. Author

N72-26013# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: TRANSINTERNATIONAL AIRLINES CORPORATION FERRY FLIGHT 863, DOUGLAS DC-8-63F, N4863T, JF KENNEDY INTERNATIONAL AIRPORT, NEW YORK
8 Sep. 1972 37 p
(NTSB-AAR-71-12) Avail: NTIS HC $4.00

A DC-8-63F, crashed during takeoff at John F. Kennedy International Airport, New York, September 8, 1970. Approximately 1,500 feet after starting takeoff, the aircraft rotated to a nose-high attitude. After 2,800 feet of takeoff roll, the aircraft became airborne and continued to rotate slowly to an attitude of approximately 60 deg to 90 deg above the horizontal at an altitude estimated to have been between 300 and 500 feet above the ground. The aircraft rolled about 20 deg to the right, rolled back to the left to an approximate vertical angle of bank, and fell to the ground in that attitude. The aircraft was destroyed by impact and postimpact fire. Eleven crewmembers, the only occupants of the aircraft, died in the accident. The probable cause of this accident was a loss of pitch control caused by the entrapment of a pointed, asphalt-covered object between the leading edge of the right elevator and the right horizontal spar web access door in the aft part of the stabilizer. The restriction to elevator movement, caused by a highly unusual and unknown condition, was not detected by the crew in time to reject the takeoff successfully. Author

N72-26014*# General Electric Co., Lynn, Mass. Aircraft Engine Group.
DESIGN OF A TF34 TURBOFAN MIXER FOR REDUCTION OF FLAP IMPINGEMENT NOISE Final Report
A. Chamay, D. P. Edkins, R. B. Mishler, and W. S. Clapper
2 Feb. 1972 131 p refs
(Contract NAS3-14330)
(NASA-CR-120916) Avail: NTIS HC $8.75 CSCL 21E

This portion of the TF-34 turbofan quiet engine studies has been devoted to the selection and design of a special mixer exhaust nozzle system to reduce the maximum 150 m (500 foot) sideline noise generated by the impingement of four engine exhausts on a STOL wing flap system to less than 92 PNdB. The design concept selected consists of a 12-lobe internal mixer and a 12-lobe external mixer mounted in series. The internal mixer reduces maximum exhaust velocities by mixing the fan and turbine streams. The external mixer is designed to reduce the velocity of the exhaust stream striking the wing flap surfaces. A ground test version of this concept has been designed to be installed and tested on an acoustically treated TF-34 engine nacelle, with flexibility to simulate a flight version of this concept which has also been defined. Estimated noise levels are 2 PNdB below the objective at approach and 2 PNdB above the objective at takeoff, with an uncertainty band of +3, -2 PNdB. Author

N72-26015# National Transportation Safety Board, Washington, D.C.
SPECIAL STUDY: PASSENGER SURVIVAL IN TURBOJET DITCHINGS (A CRITICAL CASE REVIEW)
5 Apr. 1972 32 p
(NTSB-AAS-72-2) Avail: NTIS HC $3.75

The conditions and circumstances which determined the outcome of the ditching of a DC-9 aircraft in regard to the survival and nonsurvival of the occupants was investigated. It was found that the passengers were prepared inadequately for the ditching due to a combination of factors including insufficient preparation time, inadequate briefings, insufficient training and the lack of proper crew coordination. It was estimated that decelerative forces were in the order of 8 to 12 g's, causing unrestrained occupants to be thrown forward, inducing seat failures and spinal injuries. The cause of seats, seatbelt, and galley equipment failures were analyzed. It was estimated that the aircraft remained afloat for 5 to 6 minutes. The fact that a life raft inflated inside the aircraft was attributed to impingement of the raft package by the galley structure, forcing the crewmembers out of the aircraft. Leadership of the crew while awaiting rescue and an inflated emergency escape slide minimized further loss of life. Recommendations were advanced dealing with increased training for crewmembers, better passenger communication techniques, increased strength requirements for seats, seatbelts, and galley equipment and the development of slide raft combinations and lifevest design. Twenty references are included. Author

N72-26016*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TRANSONIC TRANSPORT STUDY: STRUCTURES AND AERODYNAMICS
Mark D. Ardema and Louis J. Williams Jun. 1972 84 p
(NASA-TM-X-62157) Avail: NTIS HC $6.25 CSCL 01B

The structural and aerodynamic aspects of a general study of advanced transonic transports are presented. Aircraft designed to cruise at Mach numbers of 0.90, 0.98, and 1.15 were comparatively analyzed. The wings of all three aircraft employ supercritical sections, and the two aircraft with the highest cruise Mach numbers also employ fuselage area ruling. Structural/aerodynamic characteristics and interactions are investigated both parametrically and with the aid of an automated configuration optimization program. The effects of replacing conventional aluminum airframe structure by advanced filamentary composite (carbon/epoxy) structure receive particular attention. The methods employed in the structural/aerodynamic analysis are discussed. Author

N72-26017*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
GROUND AND FLIGHT TEST METHODS FOR DETERMINING LIMIT CYCLE AND STRUCTURAL RESONANCE CHARACTERISTICS OF AIRCRAFT STABILITY AUGMEN-

TATION SYSTEMS
Weneth D. Painter and George J. Sitterle Washington Jun. 1972 20 p refs
(NASA-TN-D-6867; H-682) Avail: NTIS HC $3.00 CSCL 01B

Performance criteria and test techniques are applied to stability augmentation systems (SAS) during ground testing to predict objectionable limit cycles and preclude structural resonance during flight. Factors that give rise to these problems, means of suppressing their effects, trade-offs to be considered, and ground test methods that have been developed are discussed. SAS performance predicted on the basis of these tests is compared with flight data obtained from three lifting body vehicles and the X-15 research airplane. Limit cycle and structural resonance test criteria, based upon ground and flight experience and data, were successfully applied to these vehicles. The criteria used were: The limit cycle amplitude (SAS gain multiplied by peak-to-peak angular rate) shall not exceed 0.5 deg for the highest product of control power and SAS gain that will be used in flight; the maximum in-flight SAS gain should never exceed 50 percent of the value at which a structural resonance can be sustained during ground test. Author

N72-26018# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: EASTERN AIR LINES, INCORPORATED MCDONNELL DOUGLAS DC-9-31 N8943E, AND A CESSNA MODEL 206, N2110F, RALEIGH-DURHAM AIRPORT, RALEIGH, NORTH CAROLINA, 4 DECEMBER 1971
5 Apr. 1972 15 p refs
(NTSB-AAR-72-13) Avail: NTIS HC $3.00

On December 4, 1971, a Douglas DC-9-31, on a regularly scheduled flight from Miami, Florida, to Washington, D. C., with en route stops at Raleigh, North Carolina, and Norfolk, Virginia, and a Cessna 206, collided in midair. The collision occurred between the outer marker and the threshold of Runway 5 of the Raleigh-Durham Airport at Raleigh, North Carolina. Both aircraft were in communication with and under the control of the Raleigh-Durham Tower local controller. The DC-9 overtook the Cessna and descended on top of that aircraft. The tower local controller had cleared the DC-9 to land. Previous to this clearance, he had advised the Cessna pilot that Runway 5 was the active runway and to report on a 3-mile final approach for possible straight-in landing. The probable cause of this accident was the inadequacy of air traffic control facilities and services in the Raleigh-Durham terminal area. The relative flightpaths of the two aircraft and the configurations physically limited each flightcrew's ability to see and avoid the other aircraft. Author

N72-26019# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: CHICAGO AND SOUTHERN AIRLINES, INCORPORATED, BEECH E18S (ATECO WESTWIND 2) N51CS, PEORIA, ILLINOIS, 21 OCTOBER 1971
19 Apr. 1972 28 p refs
(NTSB-AAR-72-15) Avail: NTIS HC $3.50

Chicago & Southern Airlines, Inc., Flight 804 of October 21, 1971, crashed while executing an instrument approach to the Greater Peoria Airport, Peoria, Illinois. All of the 16 persons on board received fatal injuries. The aircraft made initial contact with powerlines which cross the midpoint of the instrument final approach course, approximately 2 miles west of Runway 12 of the Greater Peoria Airport. The aircraft thereafter contacted the ground, bounced and slid into the base of a large hedgewood tree 152 feet from the point of initial wire contact along a wreckage path of 050 deg magnetic. An intense fire ensued which almost completely destroyed the cockpit and cabin area of the fuselage. The probable cause of this accident was that the pilot knowingly descended below the minimum descent altitude in an attempt to complete the approach by means of visual reference to ground objects. Because of minimal visibility and low clouds in the approach zone, the aircraft was operated at an altitude too low to provide clearance over the powerlines. Author

N72-26020# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORT: PAN AMERICAN WORLD AIRWAYS, INCORPORATED BOEING 747-121, N739PA NEAR NANTUCKET, MASSACHUSETTS, 4 NOVEMBER 1970
3 May 1972 19 p
(NTSB-AAR-72-14) Avail: NTIS HC $3.00

On November 4, 1970, a Pan American World Airways, Inc., Boeing 747-121, on a scheduled flight from John F. Kennedy International Airport, New York, to Orly Airport, Paris, France, encountered moderate to briefly severe turbulence at 27,000 feet as it passed Nantucket, Massachusetts. During the encounter which lasted approximately 4 minutes 10 seconds, 21 passengers and two stewardesses sustained injuries which ranged from minor to serious. The seatbelt sign was on at the time of the encounter and had been on since takeoff. Shortly after the turbulence encounter, the flight returned to John F. Kennedy International Airport, New York. The probable cause of this accident was the entry of the aircraft into an area of moderate to briefly severe turbulence associated with convective activity while numerous occupants were unsecured by seatbelts, even though the seatbelt sign was lighted. Author

N72-26021*# General Dynamics/Pomona, Calif. Electro Dynamic Div.
THEORETICAL PREDICTION OF INTERFERENCE LOADING ON AIRCRAFT STORES. PART 1: SUBSONIC SPEEDS
F. DanFernandes Jun. 1972 91 p refs
(Contract NAS1-10374)
(NASA-CR-112065-1) Avail: NTIS HC $6.75 CSCL 01B

A method is developed for theoretically predicting the loading on pylon-mounted stores in subsonic compressible flow. Linear theory is used, without two-dimensional or slender body assumptions, to predict the flow field produced by the aircraft wing, nose, inlet, and pylons. The interference loading is integrated over the store length by considering the local crossflow, its axial and radial derivatives, and buoyancy. Store moment calculations under an F-4 aircraft at Mach 8 are compared to wind tunnel data. The method is computerized, and program user information is included. Author

N72-26022*# General Dynamics/Pomona, Calif. Electrodynamic Div.
THEORETICAL PREDICTION OF INTERFERENCE LOADING ON AIRCRAFT STORES. PART 2: SUPERSONIC SPEEDS
F. DanFernandes Jun. 1972 95 p refs
(Contract NAS1-10374)
(NASA-CR-112065-2) Avail: NTIS HC $6.75 CSCL 01B

A method is developed for theoretically predicting the loading on pylon-mounted stores in supersonic flow. Linear theory is used, without two dimensional or slender body assumptions, to predict the flow field produced by the aircraft wing, nose, inlet, and pylons. Aircraft shock wave locations are predicted, and their effect on the flow field is included through a transformation of the aircraft geometry. The interference loading is integrated over the store length by considering the local crossflow, its axial and radial derivatives, and buoyancy. Store moment calculations under an F-4 aircraft at Mach 1.2 are compared to wind tunnel data. The method is computerized, and program user information is included. Author

N72-26023*# General Dynamics/Pomona, Calif. Electro Dynamic Div.
THEORETICAL PREDICTION OF INTERFERENCE LOADING ON AIRCRAFT STORES. PART 3: PROGRAMMER'S MANUAL
F. DanFernandes Jun. 1972 114 p
(Contract NAS1-10374)
(NASA-CR-112065-3) Avail: NTIS HC $7.75 CSCL 01B

A FORTRAN program is described for predicting interference loading on aircraft stores. An analysis of the program is presented from a programmer's point of view, including program organization, subroutine explanations, and FORTRAN variable definitions. This information is intended for use in any program modification, extension, or troubleshooting efforts. This manual is supplementary to the separately documented program theory and user information. Author

N72-26024*# Lockheed-California Co., Burbank.
STUDY OF AIRCRAFT IN INTRAURBAN TRANSPORTATION SYSTEMS
E. G. Stout Washington NASA Mar. 1972 156 p refs
(Contract NAS2-5989)
(NASA-CR-1991) Avail: NTIS HC $3.00 CSCL 01B

A systems analysis was conducted to define the technical economic and operational characteristics of an aircraft transportation system for short-range intracity commuter operations. The analysis was for 1975 and 1985 in the seven county, Detroit, Michigan area. STOL and VTOL aircraft were studied in sizes from 40 to 120 passengers. The preferred vehicle for the Detroit area was the deflected slipstream STOL. Since the study was parametric in nature, it is applicable to generalization, and it was concluded that a feasible intraurban air transportation system could be developed in many viable situations. Author

N72-26025*# Boeing Co., Philadelphia, Pa. Vertol Div.
A COMPARISON OF OPTIMAL AND NOISE-ABATEMENT TRAJECTORIES OF A TILT-ROTOR AIRCRAFT
F. H. Schmitz, W. Z. Stepniewski, J. Gibs, and W. Z. Hinterkeuser Washington NASA May 1972 165 p refs Sponsored in part by Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.
(Contract NAS2-5025)
(NASA-CR-2034) Avail: NTIS HC $3.00 CSCL 01B

The potential benefits of flight path control to optimize performance and/or reduce the noise of a tilt-rotor aircraft operating in the takeoff and landing phases of flight are investigated. A theoretical performance-acoustic model is developed and then mathematically flown to yield representative takeoff and landing profiles. Minimum-time and minimum-fuel trajectories are compared to proposed noise-abatement profiles to assess the reductions in annoyance possible through flight path control. Significant reductions are feasible if a nearly vertical-takeoff flight profile is flown near the landing site; however, the time expended and fuel consumed increase. Author

N72-26026# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
APPROXIMATE CALCULATION OF CANOPY SHAPE, FORCES AND STRESSES OF A FLAT CIRCULAR PARACHUTE IN STEADY DESCENT
Christos Saliaris 9 Dec. 1971 96 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-98) Avail: NTIS HC $7.00; DFVLR Porz: 19,50 DM

The relations between pressure distribution, canopy shape, and stresses in lines and fabric are derived for the steady descent of a flat circular parachute. In contrast to previous investigations both circumferential and meridian stresses are taken into consideration. Thus, six first-order differential equations and eight algebraic relations are obtained. Using a measured pressure distribution these equations are solved for the drag, the stresses, and the shape. The calculations include extended parameter variations. A comparison with other results shows satisfactory agreement. Author (ESRO)

N72-26027# Ultrasystems, Inc., Newport Beach, Calif.
AIRCRAFT RELIABILITY AND MAINTAINABILITY SITUATION (ARMS) Final Report
John P. Convey, Jr. and Stanley Cohen Sep. 1971 101 p refs
(Contract DAAJ02-71-C-0007; DA Proj. 1F1-62205-A-119)
(AD-738536; USAAMRDL-TR-71-43) Avail: NTIS CSCL 01/3

The report describes the intermediate logic flow diagrams for a computerized simulation model of U. S. Army aircraft operations. The primary objective of the model is to provide a tool for timely and realistic evaluation of system reliability and maintainability. Also, an objective of the model is the calculation of the operational availability of the aircraft being simulated. The acronym ARMS (Aircraft Reliability and Maintainability Simulation) is given to the model developed in the report. The logic flows are structured to be consistent, where feasible, with the Navy's current VALUE IV (Validated Aircraft Logistics Utilization Evaluation) model. Consistency with VALUE IV is desired so that its programming may be utilized directly, to the maximum possible extent, when the ARMS program is written. It is recommended that the Army proceed with the programming and implementation of ARMS as soon as practicable. Author (GRA)

N72-26028# Naval Aerospace Medical Research Lab., Pensacola, Fla.
MAJOR ORIENTATION ERROR ACCIDENTS IN REGULAR ARMY UH-1 AIRCRAFT DURING FISCAL YEAR 1968: ACCIDENT FACTORS
W. Carroll Hixson, Jorma I. Niven, and Emil Spezia 29 Oct. 1971 40 p refs
(AD-738808; NAMRL-1147;
USAARL-MF12.524.005-5016BX1J9) Avail: NTIS CSCL 01/2

The report is the second in a longitudinal series of reports dealing with the pilot disorientation/vertigo problem in Regular Army UH-1 helicopter operations. Individual case history data extracted from the USABAAR master aircraft accident files are presented on 52 major orientation-error accidents that occurred in UH-1 aircraft during fiscal year 1968. Summary data listings involving a variety of operational and pilot-related accident factors are presented for each of the cases. The listings are arranged to distinguish between those factors and events present before takeoff; i.e., the initial conditions associated with a given accident, and those which occurred or were manifested during the actual airborne phase of the accident. GRA

N72-26029# Army Aviation Systems Command, St. Louis, Mo.
TWO METHODS OF PREDICTION OF HOVERING PERFORMANCE
Harold Y. H. Law Feb. 1972 80 p refs
(AD-738531; USAAVSCOM-TR-72-4; ADS-TN-69-1) Avail: NTIS CSCL 01/2

The report presents two methods of prediction on the hovering performance of single-rotor helicopters. A generalized equation was formulated by the use of numerical and empirical techniques from flight test data for the prediction of hovering performance. This generalized equation leads to two methods of prediction: the Generalized Method and the Two-Point Method. Both of these methods of prediction are simple and easy to apply, and require only limited flight data information to predict the entire range of hovering performance. The accuracy of these methods falls within 5% of the flight data. Specific working examples and procedures are given. GRA

N72-26030# Naval Aerospace Recovery Facility, El Centro, Calif. AERO Structures Dept.
STUDY OF CH-53A HELICOPTER FLIGHT LOAD PARAMETERS Final Report
Ralph E. Vining 15 Sep. 1971 58 p refs
(AD-739332; NADC-ST-7112) Avail: NTIS CSCL 01/3

A flight loads survey was performed on four CH-53A helicopters to determine whether design limits were being exceeded under actual operating conditions in the field. The survey obtained a total of 133.40 hours of valid flight data in 1968 - 1969. By means of recording oscillographs, analog records were obtained for airspeed, altitude, outside air temperature, normal acceleration, rotary wing RPM, cruise guide indication, engine torque, and landing/take-off indication. The report presents a reduction of these data in the form of histograms, graphs and tables. GRA

N72-26828 Sandia Labs., Albuquerque, N.Mex.
THE DYNAMIC ENVIRONMENT OF SELECTED MILITARY HELICOPTERS
Mark B. Gens *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 153-161 refs
Supported by AEC (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26909 Army Materials and Mechanics Research Center, Watertown, Mass.
RESPONSE OF HELICOPTER ROTOR BLADES TO RANDOM LOADS NEAR HOVER
C. Lakshmikantham and C. V. JogaRao *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 37-45 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators, and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N72-26031* Westinghouse Electric Corp., Pittsburgh, Pa.
THERMALLY CASCADED THERMOELECTRIC GENERATOR Patent
Robert Flaherty, inventor (to NASA) Issued 30 May 1972 8 p
Filed 24 Jul. 1969 Supersedes N70-10898 (08-01, p 0008)
Sponsored by NASA
(NASA-Case-NPO-10753; US-Patent-3,666,566; US-Patent-Appl-SN-844355; US-Patent-Class-136-202) Avail: US Patent Office CSCL 10A

A thermally cascaded thermoelectric generator is disclosed. The generator includes a first stage containing high-temperature thermoelectric elements and a second stage containing lower temperature thermoelectric elements. The stages are connected in thermal series by means of an elongated heat transfer pipe containing a liquid metal and a wick. A portion of the heat radiated to the first stage from a high temperature radioisotope source is converted to electricity. The heat rejected by the first stage is conducted to the heat pipe and absorbed by the liquid metal as latent heat of vaporization. The vapor rises to the second stage and condenses to give up latent heat of condensation which is transferred to the second stage and is converted to electricity therein. The condensed liquid returns on the wick to the vicinity of the first stage.
Official Gazette of the U.S. Patent Office

N72-26032*# AiResearch Mfg. Co., Los Angeles, Calif.
PRELIMINARY DESIGN OF AN AUXILIARY POWER UNIT FOR THE SPACE SHUTTLE. VOLUME 5: SELECTED SYSTEM CYCLE PERFORMANCE DATA
M. L. Hamilton and W. L. Burriss May 1972 154 p
(Contract NAS3-14408)
(NASA-CR-1997; Rept-71-7300-3.3) Avail: NTIS HC $3.00 CSCL 10B

Detailed cycle steady-state performance data are presented for the final auxiliary power unit (APU) system configuration. The selection configuration is a hydrogen-oxygen APU incorporating a recuperator to utilize the exhaust energy and using the cycle hydrogen flow as a means of cooling the component heat loads. The data are given in the form of computer printouts and provide the following: (1) verification of the adequacy of the design to meet the problem statement for steady-state performance; (2) overall system performance data for the vehicle system analyst to determine propellant consumption and hydraulic fluid temperature as a function for varying mission profiles, propellant inlet conditions, etc.; and (3) detailed component performance and cycle state point data to show what is happening in the cycle as a function of the external forcing functions. D.L.G.

N72-26033*# Ion Physics Corp., Burlington, Mass.
SILICON SOLAR CELL DEVELOPMENT AND RADIATION EFFECTS STUDY FOR LOW TEMPERATURE AND LOW ILLUMINATION INTENSITY OPERATION, VOLUME 2
Allen R. Kirkpatrick Jan. 1972 49 p refs
(Contract NAS2-5516)
(NASA-CR-114429) Avail: NTIS HC $4.50 CSCL 10A

The results are presented of a study to determine the effect of in-situ proton irradiation upon low temperature, low intensity performance of several cell types. The cell types were selected in an attempt to distinguish variations in temperature-dependent radiation resistance which could be attributed to the n-p or p-n structure, diffused or implanted junctions, crucible grown or float-zone type base material, and high or low base resistivity. The results indicate that while expected variations of performance occur at room temperature, all cell types degrade more or less similarly at lower temperatures with normalized degradation becoming increasingly rapid as temperature is reduced. Recommendations for an optimized cell for Jupiter probe use are included along with a definition of the testing required on these cells to insure good performance characteristics. D.L.G.

N72-26034*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
CONSIDERATIONS WITH RESPECT TO THE DESIGN OF SOLAR PHOTOVOLTAIC POWER SYSTEMS FOR TERRESTRIAL APPLICATIONS
Paul A. Berman 15 Jun. 1972 16 p refs
(Contract NAS7-100)
(NASA-CR-127031; JPL-TR-32-1558) Avail: NTIS HC $3.00 CSCL 10A

The various factors involved in the development of solar photovoltaic power systems for terrestrial application are discussed. The discussion covers the tradeoffs, compromises, and optimization studies which must be performed in order to develop a viable terrestrial solar array system. It is concluded that the technology now exists for the fabrication of terrestrial solar arrays but that the economics are prohibitive. Various approaches to cost reduction are presented, and the general requirements for materials and processes to be used are delineated. Author

N72-26035*# Gould, Inc., Mendota Heights, Minn.
NON-GASSING NICKEL-CADMIUM BATTERY ELECTRODES AND CELLS Quarterly Report, 15 Dec. 1971 - 15 Mar. 1972
E. Luksha and D. J. Gordy 1 May 1972 24 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953184)
(NASA-CR-127061; QR-3; Rept-712-122-3) Avail: NTIS HC $3.25 CSCL 10C

Supposedly long-lived nickel-cadmium batteries often fail due to severe gassing on charge. In order to increase the lives of such cells attempts are being made to construct nongassing positive and negative electrodes. The gassing characteristics of both electrodes in negative limited cells were determined as a function of charge rate, charge temperature, and loading. Cycle life tests, up to 70 cycles, of some of the cells show they operate in a nongassing manner with very low degradation rates. Author

N72-26036*# ESB, Inc., Raleigh, N.C. Exide Missile and Electronics Div.
HEAT STERILIZABLE IMPACT RESISTANT CELL DEVELOPMENT Final Report, 1 Oct. 1967 - 1 Sep. 1971
A. W. Jordan Oct. 1971 100 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951296)

(NASA-CR-127192) Avail: NTIS HC $7.00 CSCL 10C

Developments in the design and fabrication of 25 AH, 5AH, 70 AH, and 25 AH high impact cells and batteries are reported along with the development of high cycle life, low impact cells. Discussions of the performance and failure modes are included. F.O.S.

N72-26037*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTEGRATED ENGINE-GENERATOR CONCEPT FOR AIRCRAFT ELECTRIC SECONDARY POWER
Richard R. Secunde, Robert P. Macosko, and David S. Repas Washington Jun. 1972 20 p refs
(NASA-TM-X-2579; E-6804) Avail: NTIS HC $3.00 CSCL 10A

The integrated engine-generator concept of locating an electric generator inside an aircraft turbojet or turbofan engine concentric with, and driven by, one of the main engine shafts is discussed. When properly rated, the generator can serve as an engine starter as well as a generator of electric power. The electric power conversion equipment and generator controls are conveniently located in the aircraft. Preliminary layouts of generators in a large engine together with their physical sizes and weights indicate that this concept is a technically feasible approach to aircraft secondary power. Author

N72-26038*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN H2-O2 AUXILIARY POWER UNIT FOR SPACE SHUTTLE
Donald G. Beremand, Joseph P. Joyce, and Harry M. Cameron 1972 6 p refs Proposed for presentation at 7th Intersoc. Energy Conversion Eng. Conf., San Diego, Calif., 25-29 Sep. 1972
(NASA-TM-X-68084) Avail: NTIS HC $3.00 CSCL 10A

Auxiliary power units operating on hydrogen and oxygen have the potential for significantly improved performance and payload for space shuttle vehicles. A recuperated open cycle hydrogen-oxygen turbine driven power system concept with pressure modulated reactant control is considered. The reference system, the control mode, component arrangement, performance potential, and the technology program for this system are discussed. Author

N72-26039# Argonne National Lab., Ill. Chemical Engineering Div.
LITHIUM/CHALCOGEN SECONDARY CELLS FOR COMPONENTS IN ELECTRIC VEHICULAR-PROPULSION GENERATING SYSTEMS Interim Technical Summary Report, 23 Nov. 1970 - 22 May 1971
E. C. Gay, J. D. Arntzen, E. J. Cairns, J. E. Kincinas, J. G. Riha, L. E. Trevorrow, W. J. Walsh, and D. S. Webster Jan. 1972 54 p refs
(Contract W-31-109-eng-38)
(ANL-7863; ITSR-4) Avail: NTIS

Progress in the program to develop the technology for constructing and testing 50-kW lithium/chalcogen secondary batteries for propelling military vehicles is reported. Seventeen liquid-electrolyte cells and five paste-electrolyte cells of approximately 7.5-cm diameter were tested. The best electrical performance was achieved with a liquid-electrolyte cell containing Li/(LiF-LiCl-KCl/Li in 14.3 wt % S-40.7 wt % Se-4.5 wt % Tl alloy). The resistance of lithium of several lithium aluminate fillers prepared by different techniques was investigated. Results indicate that acid-washed filler (required to remove excess carbonate used in preparing the filler) with subsequent drying at approximately 700 C showed the best stability to molten lithium at 400 C. F.O.S.

N72-26040# Naval Postgraduate School, Monterey, Calif.
THERMAL STABILIZATION OF A THERMIONIC DIODE COLLECTOR M.S. Thesis
Robert Edwin Schantz Dec. 1971 64 p refs
(AD-738884) Avail: NTIS CSCL 10/2

The efficiency of the thermionic diode direct energy converter is dependent upon the interrelated collector temperature, emitter temperature, space charge control and operating load. For instructional purposes it is desirable to be able to vary one parameter at a time while holding the remaining parameters constant. A control system to maintain the collector temperature independent of the other parameter variations is proposed. Using feedback control techniques, a positioning servo mechanism is employed to regulate heat input to the thermionic diode collector. Operating characteristics of the diode and control system results are presented. Author (GRA)

N72-26041# Lear Siegler, Inc., Cleveland, Ohio. Power Equipment Div.
BRUSHLESS DC STARTER GENERATOR Final Report, Jun. 1966 - Aug. 1970
Vytautas F. Janonis Jan. 1971 262 p refs
(Contract AF 33(615)-3625; AF Proj. 8128)
(AD-738707; TR-132; AFAPL-TR-71-20) Avail: NTIS CSCL 10/2

The report covers work performed on the design and development of a Brushless dc Starter Generator System and its testing. The unit was built and tested as a dc power generator and aircraft engine starter. In the generating mode the unit produced 200 amperes at 28-30 VDC within plus or minus 0.5 V regulation. The unit was tested over the full speed range of 7700-12,000 rpm utilizing blast air cooling per MIL-G-6162(2). In the engine starting mode the unit was tested only at half rated conditions and 22 lb ft with starting torque at 385 amp input current. GRA

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N72-26042*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 101, APRIL 1972
Apr. 1972 112 p refs
(NASA-SP-7011(101)) Avail: NTIS HC $7.75 CSCL 06E

This special bibliography lists 348 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1972. Author

N72-26043*# North Carolina Univ., Chapel Hill.
DISCRIMINATION OF GRAVITATIONAL STIMULI Progress Report, 1 Feb. 1971 - 1 Mar. 1972
Fogle C. Clark 1 Mar. 1972 20 p
(Grant NGR-34-003-041)
(NASA-CR-127067) Avail: NTIS HC $3.00 CSCL 03B

The construction and installation of an animal centrifuge and its electronic support system was completed. Experimental procedures for obtaining data on the relationship between the discriminability of g differences and location along the continuum of effective weight were initiated. Data were obtained under two successive discriminations showing discrimination among g levels. In addition, there was some indication that the discriminability of differences between g levels associated with reinforcement was the same at two locations along the g continuum, although there were differences in measures of absolute discrimination at these locations. Author

N72-26044*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
FLUID DYNAMICS IN FLEXIBLE TUBES: AN APPLICATION

TO THE STUDY OF THE PULMONARY CIRCULATION
Annual Report
N. R. Kuchar 31 Dec. 1971 108 p refs
(Contract NASw-2138)
(NASA-CR-127111) Avail: NTIS HC $7.50 CSCL 06P

Based on an analysis of unsteady, viscous flow through distensible tubes, a lumped-parameter model for the dynamics of blood flow through the pulmonary vascular bed was developed. The model is nonlinear, incorporating the variation of flow resistance with transmural pressure. Solved using a hybrid computer, the model yields information concerning the time-dependent behavior of blood pressures, flow rates, and volumes in each important class of vessels in each lobe of each lung in terms of the important physical and environmental parameters. Simulations of twenty abnormal or pathological situations of interest in environmental physiology and clinical medicine were performed. The model predictions agree well with physiological data. Author

N72-26045# Advisory Group for Aerospace Research and Development, Paris (France).
SPECIAL BIOPHYSICAL PROBLEMS IN AEROSPACE MEDICINE, PART 3
A. M. Pfister, ed. Mar. 1972 126 p refs Partly in ENGLISH and FRENCH Presented at Aerospace Med. Panel Specialist Meeting, Luchon, France, 30 Sep. - 1 Oct. 1971
(AGARD-CP-95-Pt-3) Avail: NTIS HC $8.50

A biophysical approach to solving the problems faced by man when exposed to cosmic rays, electromagnetic waves, magnetic fields, and laser radiation is summarized. For individual titles, see N72-26046 through N72-26057.

N72-26046# Kiel Univ. (West Germany).
PRESENT KNOWLEDGE OF COSMIC RAYS c29
O. C. Allkofer *In* AGARD Spec. Biophys. Probl. in Aerospace Med., Pt. 3 Mar. 1972 14 p refs (See N72-26045 17-04)
Avail: NTIS HC $8.50

The main features of cosmic radiation are outlined as far as they are of interest concerning radiation hazards in SST and manned space flights. The properties of the galactic and solar component and of the radiation belts are characterized. The interactions of the primary particles with the atmosphere and the earth's magnetic field are illustrated and figures are given for the altitude and latitude dependence. Finally, the modulation effects of the galactic component due to the solar influence are discussed. Author

N72-26047# Atomic Weapons Research Establishment, Aldermaston (England). Radiation Measurements Section.
ACTIVE DOSIMETRY OF COSMIC RADIATION
E. W. Fuller *In* AGARD Spec. Biophys. Probl. in Aerospace Med., Pt. 3 Mar. 1972 11 p refs (See N72-26045 17-04)
Avail: NTIS HC $8.50

The role assumed for active dosimetry in manned space missions and high altitude flight is to enable the exposure received during flight to be controlled by on-board monitoring. The radiation environment and the need for active dosimetry in the two circumstances are reviewed and then the instrumentation available and under development for this application is described. Methods of calibrating such instrumentation are also considered. It is concluded that satisfactory instruments for both applications are presently available but that there is a need for continuing development of more compact systems for high altitude aircraft. Author

N72-26048# Centre de Recherches Nucleaires, Strasbourg (France). Lab. de Physique Corpusculaire.
PASSIVE DOSIMETRY OF COSMIC RADIATION [DOSIMETRIE PASSIVE DU RAYONNEMENT COSMIQUE]
R. Kaiser *In* AGARD Spec. Biophys. Probl. in Aerospace Med. pt. 3 Mar. 1972 9 p In FRENCH (See N72-26045 17-04)
Avail: NTIS HC $8.50

The use of passive dosimetry to study the biological effects of cosmic radiation is discussed. The problems and functions of using such equipment are also examined. Experimental dose rates were calculated and compared to measured ones. Results are given in tables. Transl. by E.H.W.

N72-26049# Centre d'Enseignement et de Recherches de Medecine Aeronautique, Paris (France).
SOME CONSIDERATIONS ON THE DIFFICULTIES OF DOSIMETRIC EVALUATION AND COSMIC RADIATION INJURIES [QUELQUES CONSIDERATIONS SUR LES DIFFICULTES DE L'EVALUATION DOSIMETRIQUE ET LESIONNELLE DES RADIATIONS COSMIQUES]
S. Despres, C. Nogues, and G. Deltour *In* AGARD Spec. Biophys. Probl. in Aerospace Med., Pt. 3 Mar. 1972 6 p In FRENCH (See N72-26045 17-04)
Avail: NTIS HC $8.50

The difficulties encountered in the dosimetric evaluation of cosmic rays and their effect on living matter are reported. Data cover the effects of heavy ions on skin pigments, nervous tissue, human cells in culture, biological molecules, and microorganisms. Transl. by E.H.W.

N72-26050# Toulouse Univ. (France). Lab. de Biologie Medicale.
EVIDENCE ON THE EFFECT OF NATURAL IONIZING RADIATION ON BIOLOGICAL STIMULATION [MISE EN EVIDENCE D'UN EFFET BIOLOGIQUE DE STIMULATION DES RADIATIONS IONISANTES NATURELLES]
H. Planel, J. P. Soleilhavoup, R. Tixador, M. C. Giess, and F. Croute *In* AGARD Spec. Biophys. Probl. in Aerospace Med., Pt. 3 Mar. 1972 12 p refs In FRENCH (See N72-26045 17-04)
Avail: NTIS HC $8.50

The effects of radioprotection and very weak irradiations on unicellular organism multiplication and embryonic development of Drosphila melonogaster are studied. Results show that in unicellular organisms, irradiation prolonged the cellular cycle and reduced multiplication. When the organisms were returned to a radioprotected environment, their multiplication and cellular cycles returned to normal. In the fruit fly, radiation exposure caused prolonged embryonic and larvae development. Transl. by E.H.W.

N72-26051*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
VISUAL PHENOMENA INDUCED BY COSMIC RAYS AND ACCELERATED PARTICLES
Cornelius A. Tobias, Thomas F. Budinger, John T. Leith, Abdel-Megid Mamoon, and Philip Chapman *In* AGARD Spec. Biophys. Probl. in Aerospace Med., Pt. 3 Mar. 1972 12 p refs Prepared in cooperation with Calif. Univ., Berkeley (See N72-26045 17-04)
(NASA-TM-X-68460) Avail: NTIS HC $3.00 CSCL 06R

Experiments, conducted at cyclotrons together with observations by Apollo astronauts, suggest with little doubt that cosmic nuclei interacting with the visual apparatus cause the phenomenon of light flashes seen on translunar and transearth coast over the past four Apollo missions. Other experiments with high and low energy neutrons and a helium ion beam suggest that slow protons and helium ions with a stopping power greater than 10 to the 8th power eV/gram sq cm can cause the phenomenon in the dark adapted eye. It was demonstrated that charged particles induced by neutrons and helium ions can stimulate the visual apparatus. Some approaches to understanding the long term mission effects of galactic cosmic nuclei interacting with man and his nervous system are outlined. Author

N72-26052# Centre de Recherches Nucleaires, Strasbourg (France). Lab. de Physique Corpusculaire.
FIRST RESULTS OF PASSIVE DOSIMETRIC COSMIC

RADIATION EFFECTS ONBOARD A PROTOTYPE OF THE CONCORDE 001 SUPERSONIC TRANSPORT [PREMIERS RESULTATS DE LA DOSIMETRIE PASSIVE DU RAYONNEMENT COSMIQUE EFFECTURE A BORD DU PROTOTYPE DE L'AVION DE TRANSPORT SUPERSONIQUE CONCORDE 001]
R. Kaiser, A. M. Pfister, and R. P. Delahave *In* AGARD Spec. Biophys. Probl. in Aerospace Med., Pt. 3 Mar. 1972 10 p refs In FRENCH (See N72-26045 17-04)
Avail: NTIS HC $8.50

After a description of the characteristics of passive dosimetry carried out with the aid of equipment installed onboard a French prototype of the Concorde supersonic transport aircraft, the methods used to calculate the cosmic radiation dose rates and the results obtained are given. A preliminary interpretation of dose rates was made and compared to those obtained in an English prototype. The results from this comparison show the dose rates are in agreement.
Transl. by E.H.W.

N72-26053# Service de Sante des Armees, Toulon (France).
BIOLOGICAL EFFECTS OF UHF ELECTROMAGNETIC RADIATION [EFFETS BIOLOGIQUES DES RAYONNEMENTS ELECTROMAGNETIQUES UHF (RADARS)]
R. Joly and B. Servantie *In* AGARD Spec. Biophys. Probl. in Aerospace Med., Pt. 3 Mar. 1972 14 p refs In FRENCH (See N72-26045 17-04)
Avail: NTIS HC $8.50

Very high frequency radiation effects, emitted by radar equipment, on the human organism are investigated. The physiological and physiopathological aspects are outlined. Data also cover pulse duration, penetrative power, energy density, and exposure time. Transl. by E.H.W.

N72-26054# Bureau of Medicine and Surgery, Washington, D.C.
THE US NAVY'S PROGRAM IN NONIONIZING RADIATION
Paul E. Tyler *In* AGARD Spec. Biophys. Probl. in Aerospace Med., Pt. 3 Mar. 1972 4 p refs (See N72-26045 17-04)
Avail: NTIS HC $8.50

The extent of dependence of military forces upon electromagnetic radiation emitters for their day-to-day operations is discussed. The current concepts and safety standards of the Eastern European countries are reviewed briefly. The current Navy program in the area of nonionization radiation is presented. Three major approaches are emphasized: (1) basic research, (2) exploratory research, and (3) epidemiological surveys. The lack of adequate dosimetric instrumentation is discussed and the current program to develop instrumentation is presented. Author

N72-26055*# Naval Aerospace Medical Research Lab., Pensacola, Fla.
MAGNETIC FIELDS AND MAN: WHERE DO WE STAND TODAY?
Dietrich E. Beischer and Vernon R. Reno *In* AGARD Spec. Biophys. Probl. in Aerospace Med., Pt. 3 Mar. 1972 9 p refs Sponsored in part by NASA (See N72-26045 17-04)
(NASA-CR-127049) Avail: NTIS HC $3.00 CSCL 06R

An assessment is made of the effects of very low and very high magnetic fields on man. In preparation for the Apollo flights, magnetic fields of 50 gamma were generated in the laboratory by two different methods. Human volunteers were tested with a comprehensive battery of physiological and psychological tests during and after continuous exposure for various time periods. No significant difference due to the low field was found for exposure periods of up to 10 days. Technological advancements in power generation, antisubmarine warfare, and energy storage and transmission expose man to magnetic fields many orders of magnitude higher than those heretofore encountered. The only available information relevant to these conditions is based upon occasional observations in high energy physics laboratories and Soviet descriptions of clinical effects. Results on incidental human exposure and of primates exposed to high fields indicate that, while actual survival is not threatened by such exposures, high fields can influence man to a degree sufficient to cause serious performance decrement. Author

N72-26056# Duke Univ., Durham, N.C. Dept. of Ophthalmology.
LASER SAFETY AND HOW TO PROMOTE IT
Myron L. Wolbarsht *In* AGARD Spec. Biophys. Probl. in Aerospace Med., Pt. 3 Mar. 1972 6 p refs (See N72-26045 17-04)
(Contract N00014-67-A-0251-0011)
Avail: NTIS HC $8.50

The characteristics of lasers which may produce danger are briefly discussed with regard to the special characteristics of laser light and also the characteristics they share with other light sources. Types of personnel protection are considered as are regulations and safety programs in relation to the energy and power levels that are currently thought to be nonhazardous. The principles of hazard analysis are described in conjunction with their use at any particular safety level. Two of the programs carried on by the U.S. Navy Medical Department on laser safety are considered in detail. One deals with the functional decrement in visual acuity of monkeys by pulsed laser trains in the near infrared. The other is concerned with the determination of threshold levels for ocular injury by lasers in human volunteers.
Author

N72-26057# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
LASER SAFETY: SOME CONSIDERATIONS IN THE DESIGN OF A CODE OF PRACTICE
R. G. Borland *In* AGARD Spec. Biophys. Probl. in Aerospace Med., Pt. 3 Mar. 1972 13 p refs (See N72-26045 17-04)
Avail: NTIS HC $8.50

Military and industrial research on a safety code for the use of laser equipments is outlined. Data cover safe thresholds, methods for measuring these thresholds, and characteristics of the laser to be used. Special attention is given to retina damage in the operators. E.H.W.

N72-26058*# Naval Aerospace Medical Research Lab., Pensacola, Fla.
OCULAR COUNTERROLLING MEASURED DURING EIGHT HOURS OF SUSTAINED BODY TILT
Earl F. Miller, II and Ashton Graybiel 4 Jan. 1972 11 p refs
(NASA Order T-81633; NASA Order L-43518)
(NASA-CR-127034; NAMRL-1154) Avail: NTIS HC $3.00 CSCL 06S

Adaptation of otolith organ activity was investigated by monitoring the ocular counterrolling response of four normal individuals and three persons with severe bilateral loss of labyrinthine function. Several eye photographs were recorded every 30 minutes during a period of 8 hours in which the subject was held in a lateral tilt (60 deg) position. The recorded eye roll position varied to an expected small extent within each test session; this variation about a given mean roll position was similar among the test sessions for all subjects. The mean roll position, on the other hand, changed from session to session in substantial amounts, but these changes appeared to be random with respect to time and among subjects. Furthermore, the intersessional variation in the mean torsional eye position of the normal subjects was equivalent to that of the labyrinthine-defective subjects who displayed little or no counterrolling. These results suggest that the human counterrolling response is maintained either by essentially nonadapting macular receptors or by extremely fine movements of the head in the gravitational field, such as may have been allowed by the biteboard/headrest restraint system used in this study, which served as an everchanging accelerative stimulus. Author

N72-26059# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

INVESTIGATIONS ON THE BIOLOGICAL EFFECT OF SHOCK WAVES TRANSMITTED THROUGH DIFFERENT MATERIALS

O. Wuensche and G. Scheele 1972 30 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-13) Avail: NTIS HC $3.50; DFVLR Porz-Wahn; 10,60 DM

The special effect of shock waves transmitted through different materials to animal organs is dealt with. Miniature pigs were used for the study. In particular, the typical and reproducible injuries of organs which are caused by defined shock waves on predetermined body regions are demonstrated, described in detail, and verified by photographs. The morphological findings are discussed, and the particulars of special damage effects are given. Author

N72-26060# Joint Publications Research Service, Arlington, Va.
HUMAN ACCLIMATIZATION IN THE POLAR REGIONS
13 Jun. 1972 213 p refs Transl. into ENGLISH from Akklimatizatsiya Cheloveka v Usloviyakh Polyarnykh Rayonov (Leningrad), 1969
(JPRS-56252) Avail: NTIS HC $12.75

A collection of reports is presented on acclimatization, adaptation, and psychophysiological aspects of man in the polar regions. Author

N72-26061# Joint Publications Research Service, Arlington, Va.
TRANSLATION ON EASTERN EUROPE SCIENTIFIC AFFAIRS, NO. 248
7 Jun. 1972 44 p refs Transl. into ENGLISH from various East European publications
(JPRS-56202) Avail: NTIS HC $4.25

Articles are presented concerning the development of, and progress in, various theoretical and applied scientific disciplines and technical fields. Research in the fields of agriculture, computers, and cybernetics, medicine, and electronics is discussed. Author

N72-26062# Joint Publications Research Service, Arlington, Va.
MEDICAL INVESTIGATIONS DURING ARCTIC AND ANTARCTIC EXPEDITIONS
A. L. Matusov et al 9 Jun. 1972 109 p refs Transl. into ENGLISH from Tr. Med. Issled. v Arkt. i Antarkt. Ekspeditsiyakh (Leningrad), v. 299, 1971 p 15-49, 78-82, 120-124, 128-131, 177-195, and 231-235
(JPRS-56225) Avail: NTIS HC $7.50

Physiological, pathological, and psychological aspects of human acclimatization to the cold polar environment are considered. For individual titles, see N72-26063 through N72-26071.

N72-26063# Joint Publications Research Service, Arlington, Va.
ACCLIMATIZATION AND HUMAN PATHOLOGY IN ANTARCTICA
A. L. Matusov, N. R. Deryapa, I. F. Ryabinin, I. V. Shastin, and B.B. Vensenotsev *In its* Med. Invest. during Arctic and Antarctic Expeditions 9 Jun. 1972 p 1-32 refs (See N72-26062 17-04)
Avail: NTIS HC $7.50

In Antarctica predominated physiological versions of human acclimatization to the unusual conditions of a glacial continent and arising pathology assumed, predominantly, a mild form. Established deviations from the norm are restored comparatively easily which is seen by the example of disadaptational meteoneuroses. The role of the distinctive microflora of Antarctica in the development of pathological processes in man is great. The distinctiveness of the course of the wound process and inflammation and their dependence on the phase of acclimatization are established. Author

N72-26064# Joint Publications Research Service, Arlington, Va.
CLINICO-PHYSIOLOGICAL CHARACTERISTICS OF THE PROCESS OF ACCLIMATIZATION OF MAN IN ANTARCTICA
N. R. Deryapa *In its* Med. Invest. during Arctic and Antarctic Expeditions 9 Jun. 1972 p 33-46 refs (See N72-26062 17-04)
Avail: NTIS HC $7.50

Diverse changes in the vital activities of the human organism during polar acclimization were observed in protective adaptational body functions: disadaptation neurosis, shifts in cardiac reflexes, electrical skin resistance, capillary blood circulation, and skin thermotopography. The use of clinical methods did not reveal essential acclimatizational changes in external respiration, digestion, urination and the peripheral blood; normal indices of physical development were maintained. However, previously existing pathological processes in humans were aggravated during expeditions to Antarctica. G.G.

N72-26065# Joint Publications Research Service, Arlington, Va.
BRIEF MEDICO-GEOGRAPHIC CHARACTERISTICS OF THE COURSE OF ACCLIMATIZATION IN MEMBERS OF THE BELLINSGAUZEN POLAR STATION
V. A. Zabarsakin and Yu. G. Shalunov *In its* Med. Invest. during Arctic and Antarctic Expeditions 9 Jun. 1972 p 47-54 refs (See N72-26062 17-04)
Avail: NTIS HC $7.50

Physiological characteristics of human acclimatization to conditions in western Antarctica constituted pain sensations, sleep disturbances, manifestations of irritability and apathy; neuroleptics and tranquillizers usually stopped these symptoms. Some complaints of dyspnea after physical exertions, poor appetite and fatigability were also registered. The greatest number of subjective disturbances occurred during the coldest period of the wintering. G.G.

N72-26066# Joint Publications Research Service, Arlington, Va.
PSYCHOPHYSIOLOGICAL OBSERVATIONS OF POLAR EXPEDITION MEMBERS IN ANTARCTICA
B. B. Ventsenostsev *In its* Med. Invest. during Arctic and Antarctic Expeditions 9 Jun. 1972 p 55-62 refs (See N72-26062 17-04)
Avail: NTIS HC $7.50

Various psychophysiological test data on polar expedition members are reported that characterize different aspects of higher nervous activity, overall capacity to work, tempo of psychic processes and memory; all indicate improvement during wintering. Also observed is a relatively rapid adaptation of the organism to the conditions of life in coastal Antarctica. G.G.

N72-26067# Joint Publications Research Service, Arlington, Va.
THE DYNAMICS OF SLEEP OF POLAR EXPEDITION MEMBERS OF THE SEVERNYY POLYUS-15 (NORTH POLE DRIFTING RESEARCH STATION)
Yu. A. Paramonov *In its* Med. Invest. during Arctic and Antarctic Expeditions 9 Jun. 1972 p 63-67 refs (See N72-26062 17-04)
Avail: NTIS HC $7.50

Observations of motor activities and the depth and dynamics of sleep during human adaptation to Antarctic conditions are evaluated. Analyses of actograms and statistical processing of sleep duration data show a definite dependence of sleep dynamics on the natural light circle. In the period of polar day, disturbances of sleep occurred but, with the approach of the usual change of day and night, sleep deepened and improved. Also found is a definite dependence of sleep disturbances on the length of service at the Antarctic base. G.G.

N72-26068# Joint Publications Research Service, Arlington, Va.
THE STATE OF THE BLOOD SYSTEM OF POLAR EXPEDITION MEMBERS DURING WINTERING AT MOLODEZH STATION

B. B. Ventsenostsev *In its* Med. Invest. during Arctic and Antarctic Expeditions 9 Jun. 1972 p 68-75 refs (See N72-26062 17-04)
Avail: NTIS HC $7.50

Statistical processing of blood data from polar expedition members shows a somewhat lowered hemoglobin content, lowered erythrocytes, decreased leukocyte levels, and slower erythrocyte sedimentation rates. Observed decreases are associated with the photoperiodism of the polar light regime. G.G.

N72-26069# Joint Publications Research Service, Arlington, Va.
THE CHANGE OF SOME ASPECTS OF THE OXYGEN REGIME IN THE HUMAN ORGANISM DURING PROLONGED STAYS UNDER EXTREME CONDITIONS
V. S. Poggenpol and Ye. A. Ilin *In its* Med. Invest. during Arctic and Antarctic Expeditions 9 Jun. 1972 p 76-85 refs (See N72-26062 17-04)
Avail: NTIS HC $7.50

Oxygen saturation levels in human arterial blood were studied during prolonged stays in the Antarctic region. Oxygen levels were determined at rest and during the following tests: (1) holding the breath upon inhalation and exhalation; (2) forced hyperventilation; and (3) measured physical exercise. In general, the quantity of oxyhemoglobin was about 10 percent below the norm established for healthy persons. Arterial pressures changed and reached minimum values in the middle of the winter. G.G.

N72-26070# Joint Publications Research Service, Arlington, Va.
A STUDY OF THE FUNCTION OF PULMONARY RESPIRATION AMONG POLAR EXPEDITION MEMBERS IN COASTAL ANTARCTICA
I. F. Ryabinin and O. V. Korovina *In its* Med. Invest. during Arctic and Antarctic Expeditions 9 Jun. 1972 p 86-98 refs (See N72-26062 17-04)
Avail: NTIS HC $7.50

Analysis of results of spirographic examinations showed that a year's stay of polar expedition members under conditions of the severe climate of coastal Antarctica had no significant effect upon the ventilation indices of pulmonary respiration functions. Data obtained indicate the great adaptational possibilities of the respiration apparatus in man. The deterioration of bronchial permeability revealed in polar expedition members has a direct relation to the mechanism of the rise of dyspnea in polar regions of the earth. Author

N72-26071# Joint Publications Research Service, Arlington, Va.
COMPARATIVE CHARACTERISTICS OF BASIC FORMS OF CLIMATIC CLOTHING OF POLAR EXPEDITION MEMBERS OF VOSTOK STATION c05
N. I. Makarov *In its* Med. Invest. during Arctic and Antarctic Expeditions 9 Jun. 1972 p 99-105 refs (See N72-26062 17-04)
Avail: NTIS HC $7.50

For polar expedition members in the region of the Antarctic plateau, it is necessary to design new climatic clothing which will meet all the requirements for which wool, flannel and other materials are used, attempting to keep them light with a large volume of air under the clothing. As tests showed, the camel hair costume was most adaptable to the conditions. During the use of this type of protective climatic clothing, the duration of stay in the air was greatest and the value of the weighted mean heat flow and the reaction of the cardio-vascular system were minimal. The leather on fur costume was most unfavorable even during relatively mild weather. Author

N72-26072# Oklahoma Univ., Oklahoma City. Health Sciences Center.
EFFECTS OF BACKSCATTER OF BRIEF HIGH INTENSITY LIGHT ON PHYSIOLOGICAL RESPONSES OF INSTRUMENT RATED PILOTS AND NON-PILOTS
Arthur R. Zeiner and Gerhard A. Brecher Feb. 1972 11 p refs
(Contract DOT-FA71WA-2545)
(FAA-AM-72-8) Avail: NTIS HC $3.00

Thirty-nine human subjects were exposed to repetitive backscatter light stimulation from a Grimes capacitance discharge airplane anticollision light flashing at 1.27 hertz. Both tonic and phasic stimulus-bound occipital EEG, heart rate, respiration, skin potentials, and eyeblinks were recorded. In the first experiment, response decrement to the flashing light occurred only with one out of five response measures over a 40-trial session indicating that the flashing light was a potent stimulus. None of the subjects demonstrated photic driving, seizure activity, or theta wave activity in his EEG. In Experiment II, eyeblink and skin potential measures differentiated between an instrument-rated pilot group and an age-matched control group of non-pilot professional men. The results suggest that, although the flashing anticollision light induces changes in physiological measures which are resistant to habituation, these changes do not extend to the induction of nausea. Author

N72-26073*# Scientific Translation Service, Santa Barbara, Calif.
INHIBITORY EFFECTS OF EXOGENOUS GLUCOSE ON THE BIOSYNTHESIS OF PROTOHEME BY THE YEAST SACCHAROMYCES CEREVISIAE
P. Labbe Washington NASA Jun. 1972 9 p refs Transl. into ENGLISH from Compt. Rend. Soc. Biol. (France), v. 165, no. 4, 20 Apr. 1972 p 808-811
(Contract NASw-2035)
(NASA-TT-F-14330) Avail: NTIS HC $3.00 CSCL 06M

The experiments show that in yeast DAL dehydratase and ferrochelatase are not inhibited by glucose, while DAL synthetase is almost completely inhibited. Author

N72-26074*# George Washington Univ., Washington, D.C. Medical Center.
SCIENTIFIC PUBLICATIONS AND PRESENTATIONS RELATING TO PLANETARY QUARANTINE. VOLUME 5: THE 1971 SUPPLEMENT Biological Sciences Communication Project
Frank D. Bradley and Marcy R. Rettig Jul. 1972 59 p refs
(Contract NSR-09-010-027)
(NASA-CR-127112; GWU-BSCP-72-07P-Vol-5-Suppl) Avail: NTIS HC $5.00 CSCL 06M

A bibliographic compilation, with approximately 200 listings, on planetary quarantine is presented. Also given are scientific publications, and presentations along with an author index. E.H.W.

N72-26075# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Strahlenschutz.
THE CENTRAL DIVISION OF RADIATION PROTECTION Annual Report, 1970 [ARBEITSBERICHT 1970 DER ZENTRALABTEILUNG STRAHLENSCHUTZ]
M. Keller, ed. and R. Tzschaschel, ed. Sep. 1971 190 p refs In GERMAN; ENGLISH summary
(JUL-787-ST) Avail: AEC Depository Libraries

The Zentralabteilung Strahlenschutz (ZST) of the Nuclear Research Establishment, Juelich, is responsible for an adequate and a proper performance of the radiation protection programs for personnel, installations, and the environment in West Germany. This includes the introduction of the necessary organizations as well as the permanent development of measuring methods and procedures according to the most recent knowledge of science and research. Activities during 1970, as well as the results of investigations and developments in connection with the improvement of methods and procedures, are reported. A complete bibliography of the published and internal literature of the ZST in 1970 is included. Author (NSA)

N72-26076# Kansas State Univ., Manhattan. Inst. for Environmental Research.
RESPONSE OF HUMAN SUBJECTS TO REDUCED LEVELS

OF WATER CONSUMPTION UNDER SIMULATED CIVIL DEFENSE SHELTER CONDITIONS **Final Report, Sep. 1965 - Aug. 1971**
Robert L. Gorton, J. M. Rueck, P. E. McNall, Jr., B. Finkelstein, and E. L. Besch Jan. 1972 97 p refs
(Contract DAHC20-68-C-0173)
(AD-738562) Avail: NTIS CSCL 06/6

Seven tests, employing 16 subjects each, were run under carefully controlled environmental conditions similar to expected conditions in civil defense shelters. The purpose of the tests was to determine response of humans to limited water rations under such conditions. A computational method was developed for determination of body water pool loss. Nutritional, physiological and psychological testing was conducted to measure subject response to the various water rations. Results including subject weight losses and water budgets are presented. Results were analyzed and a correlation equation for water pool loss was developed. It was determined by extrapolation of these results that a water ration of 1 3/4 quarts per person per day for 14 days should prevent severe dehydration of subjects under the conditions of these tests. GRA

N72-26857 Johns Hopkins Univ., Baltimore, Md.
FINITE AMPLITUDE SHOCK WAVES IN INTERVERTEBRAL DISCS
William F. Hartman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 213-219 refs (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26278*# Maryland Univ., College Park.
REMOTE SENSING AND EXTRACTABLE BIOLOGICAL RESOURCES
L. Eugene Cronin *In* NASA, Washington Remote Sensing of the Chesapeake Bay 1972 p 83-89 refs (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 08A

N72-26768*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SURVEYOR 3: BACTERIUM ISOLATED FROM LUNAR RETRIEVED TELEVISION CAMERA
F. J. Mitchell (Texas A&M Univ., College Station) and W. L. Ellis *In its* Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 239-248 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 06M

N72-26769*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MICROBIOLOGICAL SAMPLING OF RETURNED SURVEYOR 3 ELECTRICAL CABLING
M. D. Knittel, M. S. Favero (Public Health Serv., Phoenix, Ariz.), and R. H. Green *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 248-251 refs (See N72-26731 17-30)
Avail: NTIS;SOD $4.00 CSCL 06M

05 BIOTECHNOLOGY

Includes life support systems, human engineering, protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N72-26077 Louisiana State Univ., Baton Rouge.
A HUMAN MODEL WHICH OPTIMIZES PURSUIT TRACKING **Ph.D. Thesis**
Mario Joseph Caluda, Jr. 1971 144 p
Avail: Univ. Microfilms Order No. 71-29348

The feasibility of using an adaptive linear mathematical model to represent a human operator subjected to the task of controlling an attacking fighter aircraft was investigated. The ability of the model to perform pursuit tracking tasks subject to random evader tactics was analyzed by the implementation of the model into a six degree of freedom digital fire control simulation. For the model to approach reality in every flight regime, an adaptive procedure was incorporated into the simulation to adjust the variable gain and lead time parameters of the human model. As a means of evaluating the simulated performance of the human operator when performing this task, the performance data of the attacking aircraft was subjected to a number of spectral analysis operations. These spectral operations compared the frequency content of the data obtained from the simulation to actual data obtained from combat flight maneuvers. For both sets of data the evaders performed the same identical tactics. Dissert. Abstr.

N72-26078 Connecticut Univ., Storrs.
HUMAN OPERATOR DYNAMICS FOR AUDIO COMPENSATORY TRACKING **Ph.D. Thesis**
Edward Wayne Vinje 1971 189 p
Avail: Univ. Microfilms Order No. 71-29924

Tracking error was presented to the test subjects using one- and two-ear displays. For both displays the pitch of the tone represented the magnitude of the tracking error. Error polarity was indicated in the two-ear display by switching the tone between ears as a function of error sign. For the one-ear display, error polarity was indicated by using modulated and unmodulated tones. The operator's aural control characteristics were modeled as a describing function plus a remnant. The describing function and remnant data indicate that humans can control as well with audio cues as with visual cues for the task considered. However, the reduction in operator time delays, expected because of the generally faster human response to audio stimuli, was not evident in the results. It was also determined that the operators could control equally well with either the one- or two-ear display. The operator model results indicate that the combined audio and visual presentation of tracking error neither improves the operator's control capability nor reduces operator time delays. Dissert. Abstr.

N72-26079*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
DEVELOPMENT OF A SORBER TRACE CONTAMINANT CONTROL SYSTEM INCLUDING PRE- AND POST-SORBERS FOR A CATALYTIC OXIDIZER
Thomas M. Olcott Washington NASA May 1972 185 p refs
(Contract NAS1-9242)
(NASA-CR-2027) Avail: NTIS HC $3.00 CSCL 06K

A general methodology was developed for spacecraft contaminant control system design. Elements considered for contaminant control ware catalytic oxidation with isotope or electrical heat and pre- and post-sorbers, charcoal with regeneration and non-regeneration, and reactive constituents. A technique is described for sizing a charcoal bed for a multiple contaminant load. Author

N72-26080*# Massachusetts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
MECHANISMS OF DETERIORATION OF INTERMEDIATE MOISTURE FOOD SYSTEMS
Theodore P. Labuza Washington NASA Jun. 1972 149 p refs
(Contract NAS9-9426)
(NASA-CR-114861) Avail: NTIS HC $9.50 CSCL 06H

A study of shelf stability in intermediate moisture foods was made. Major efforts were made to control lipid oxidation and nonenzymatic browning. In order to determine means of preventing these reactions, model systems were developed having the same water activity content relationship of intermediate moisture foods. Models were based on a cellulose-lipid and protein-lipid system with glycerol added as the humectant. Experiments with both systems indicate that lipid oxidation is promoted significantly in the intermediate moisture range. The effect appeared to be related to increased mobility of either reactants or catalysts, since when the amount of water in the system reached a level where capillary condensation occurred and thus free water was present, the rates of oxidation increased. With added glycerol, which is water soluble and thus increases the amount of mobile phase, the increase in oxidation rate occurs at a lower relative humidity. The rates of oxidation were maximized at 61% RH and decreased again at 75% RH probably due to dilution. No significant non-enzymatic browning occurred in the protein-lipid systems. Prevention of oxidation by the use of metal chelating agents was enhanced in the cellulose system, whereas, with protein present, the lipid soluble chain terminating antioxidants (such as BHA) worked equally as well. Preliminary studies of foods adjusted to the intermediate moisture range bear out the results of oxidation in model systems. It can be concluded that for most fat containing intermediate moisture foods, rancidity will be the reaction most limiting stability. Author

N72-26081# Joint Publications Research Service, Arlington, Va.
MAN IN PROLONGED SPACE FLIGHT
V. A. Shatalov 6 Jun. 1972 13 p Transl. into ENGLISH from Nauka'i Zhizn (Moscow), no. 3, Mar. 1972
(JPRS-56181) Avail: NTIS HC $3.00

An interview with Maj. Gen. V. A. Shatalov on the peculiarities of space flight and the training of cosmonauts for such flight is presented. Author

N72-26082# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
A SURVEY INTO THE ANNOYANCE CAUSED BY AIRCRAFT NOISE AND ROAD TRAFFIC NOISE
C. G. Bottom and D. M. Waters [1972] 39 p refs
(TT-7204) Avail: NTIS HC $4.00

The results of a social survey designed to investigate the influence of background (road traffic) noise on annoyance due to aircraft noise, and on general dissatisfaction with the total noise environment are presented. Nine sites with 3 aircraft and 3 traffic conditions were selected and 35 people per site interviewed. The regression lines for site mean aircraft annoyance scores (Guttman Scale) for each traffic condition show that the same annoyance score is achieved at an aircraft exposure 10 NN1 lower, when traffic is reduced from heavy to access only. The general noise dissatisfaction shows an increase with traffic at low NN1, but a decrease at high NN1. The use of the noise pollution level unit satisfactorily explains this result, increasing the correlation coefficient for the grouped data from 0.94 against NN1 to 0.96. Author

N72-26083# Joint Publications Research Service, Arlington, Va.
MAN IN THE CONTROL SYSTEM
V. A. Trapeznikov 15 Jun. 1972 18 p Transl. into ENGLISH from Nauka i Zhizn' (Moscow), no. 2, 1972 p 2-10
(JPRS-56277) Avail: NTIS HC $3.00

Human behavior in a control system is considered, as man and technical control means. Author

N72-26084# Joint Publications Research Service, Arlington, Va.
THE PRINCIPLES OF AN ACTIVE OPERATOR AND THE FUNCTIONAL DISTRIBUTION BETWEEN MAN AND MACHINE
N. D. Zavalova, B. F. Lomov, and V. A. Ponomarenko 19 Jun. 1972 13 p refs Transl. into ENGLISH from Vopr. Psikhologii (Moscow), no. 3, 1971 p 3-12
(JPRS-56297) Avail: NTIS HC $3.00

The role of man in control systems is considered and various approaches in engineering psychology are discussed. A proficiency analysis study is cited as an example. Author

N72-26085*# Scientific Translation Service, Santa Barbara, Calif.
METHOD OF STUDYING THE REACTIONS OF A HUMAN OPERATOR CONSIDERED AS AN OSCILLATORY SYSTEM TO HARMONIC AND RANDOM VIBRATIONAL ACTION
K. V. Frolov Washington NASA Jun. 1972 13 p refs Transl. into ENGLISH from the book "Primeneniye Teorii Nelineinykh Kolebanii v Mekhan., 5th Intern. Conf. on Nonlinear Oscillations, Trans., Kiev, 25 Aug. - 4 Sep. 1969" Kiev, Akad. Nauk Ukr. SSR, v. 3, 1971 p 695-703
(Contract NASw-2035)
(NASA-TT-F-14289) Avail: NTIS HC $3.00 CSCL 05E

The results are presented of an experimental study of the dynamic responses and functional state of a human operator subjected to harmonic and random vibrational excitation. A number of problems involved in obtaining objective estimates of the effect of vibrations of various types and spectral compositions on human operators are considered. Some possible ways of constructing human-operator models which are essentially nonlinear oscillatory systems of complex dynamical structure are indicated, and methods of investigating these models are suggested. Author

N72-26086# Southampton Univ. (England). Inst. of Sound and Vibration Research.
SECONDARY TASK PERFORMANCE OF HELICOPTER PILOTS DURING LOW-LEVEL FLIGHT
B. K. Nagaraja Rao and M. J. Griffin Dec. 1971 61 p refs Sponsored by Min. of Defense
(ISVR-TR-54) Avail: NTIS HC $5.25

An investigation was made into the changes of pilot performance at a complex reaction time task during low-level helicopter flight. The two-choice task required responses to a continuous and a similar tone pulse 6 Hz pitch repetition frequency. The mean reaction times for eight pilots are tabulated and commented upon. An extensive bibliography is appended. Author (ESRO)

N72-26087# Texas Technological Univ., Lubbock. Center of Biotechnology and Human Performance.
PERFORMANCE, RECOVERY, AND MAN MACHINE EFFECTIVENESS Semiannual Progress Report, 1 Sep. 1971 - 29 Feb. 1972
Richard A. Dudek 15 Mar. 1972 25 p refs
(Contract DAAD05-69-C-0102; DA Proj. 1T0-14501-B-81-A)
(AD-738916) Avail: NTIS CSCL 05/8

Emphasis is placed on the determination of optimal or near optimal work/rest schedules for individuals and crews to yield high performance with minimal decrement over time followed by recovery (after rest) to an acceptable high performance. The experimentation is further aimed at consideration of various task levels and differing conditions of environment. Experimentation in progress continues to focus attention on the assessment of human performance under continuous operations or relatively long term activity (2 hours or more of activity). GRA

N72-26088# Naval Postgraduate School, Monterey, Calif.
A HEART BEAT ACCUMULATOR FOR RESEARCH IN EXERCISE PHYSIOLOGY M.S. Thesis
Richard Alexander Creighton Jun. 1971 44 p refs
(AD-738882) Avail: NTIS CSCL 06/2

A system is postulated to count the total number of heart beats in one day. The device is intended for use as a possible indicator of the level of physical fitness of an individual. It is portable, self-contained, and provides for comfortable and natural movement of the subject during the course of daily activities. Electronic design is developed including detailed schematic diagrams of all electronic circuitry involved. The complete plans and photographs of a working prototype are presented. The prototype is to be further tested and evaluated in the exercise physiology laboratory at California State College at Long Beach. It is hoped that this device will prove to be of value in studies and research in physical fitness. Author (GRA)

N72-26089# Harvard Univ., Boston, Mass. Dept. of Psychiatry.
AUTOMATED CONSTANT CUFF PRESSURE SYSTEM TO MEASURE AVERAGE SYSTOLIC AND DIASTOLIC BLOOD PRESSURE IN MAN
Bernard Tursky, David Shapiro, and Gary E. Schwartz Dec. 1971 28 p refs
(Contract N00014-67-A-0298-0024; VR Proj. 144-207)
(AD-738832; TR-4) Avail: NTIS CSCL 06/2

An automated constant cuff-pressure system to remotely determine average human blood pressure levels was developed to overcome problems in measurement caused by natural beat-to-beat fluctuations in arterial pressure. A standard blood pressure cuff is inflated to approximately systolic pressure for a prescribed number of heart cycles. Korotkoff (K) sounds are picked up by a crystal microphone over the brachial artery. The ECG is recorded and an electronic coincidence circuit detects the number of R waves followed by a K sound. Cuff pressure is automatically adjusted until there is a 50% coincidence of R-K sounds. This cuff pressure is now by definition the median systolic pressure. The same procedure is followed to determine median diastolic pressure. A change in 2 mm Hg in cuff pressure alters the R-K coincidence by 25%, insuring an accuracy of measurement of plus or minus 2 mm Hg. Average measures of pressure obtained by the constant cuff pressure method were demonstrated to be as accurate as averages based on intra-arterial readings. Application of this system in epidemiological screening is discussed. Author (GRA)

N72-26194# Joint Publications Research Service, Arlington, Va.
MAN IN CONTROL SYSTEM
V. A. Trapeznikov *In its* Mater. on Fifth All-Union Controls Conf. 13 Jun. 1972 p 1-17 refs (See N72-26193 17-10)
Avail: NTIS HC $5.00

N72-26071# Joint Publications Research Service, Arlington, Va.
COMPARATIVE CHARACTERISTICS OF BASIC FORMS OF CLIMATIC CLOTHING OF POLAR EXPEDITION MEMBERS OF VOSTOK STATION
N. I. Makarov *In its* Med. Invest. during Arctic and Antarctic Expeditions 9 Jun. 1972 p 99-105 refs (See N72-26062 17-04)
Avail: NTIS HC $7.50

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N72-26090 National Lending Library for Science and Technology, Boston Spa (England).
CHAIN TERMINATION IN THE OXIDATION REACTION OF HYDROCARBONS
A. I. Poroikova and A. B. Nalbandyan 26 Feb. 1972 12 p refs Transl. into ENGLISH from Kinetika i Kataliz (USSR), v. 12, no. 4, Jul. - Aug. 1971 p 849-853
(NLL-Trans-1184-(9022.9)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

In the oxidation of hydrocarbons it is frequently observed that the addition of an inert gas increases the induction period and does not influence the magnitude of the maximum rate of reaction. It was shown that this relationship may be explained by the increase, during the reaction, of the relative concentration of a free radical, which has a low probability of wall-termination. Author

N72-26091 National Lending Library for Science and Technology, Boston Spa (England).
SEPARATION OF INORGANIC IONS IN MILLIGRAM TO DECIGRAM QUANTITIES USING COMPARTMENTED ELECTROPHORESIS
H. Meier, R. Dieberg, E. Zimmerhackl, W. Albrecht, D. Boesche, W. Hecker, P. Menge, A. Ruckdeschel, E. Unger, and G. Zeitler 29 Feb. 1972 6 p Transl. into ENGLISH from Mikrochim. Acta (Vienna), 1970 p 102-108 In ENGLISH and GERMAN
(NLL-Trans-746-1103-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

High potential, electrophoretic tests were made on mixtures of Pt/Pd and Os/Ru. Compartmental electrophoresis data are also presented for the following groups of elements for trace constituent enrichment: Ni, Fe, Mn; Sb, Co, Pt; Ni, Pt, Pd; Hg, Cu, Os; and As, Os, Ni. The last element listed in each group was the trace constituent. K.P.D.

N72-26092 National Lending Library for Science and Technology, Boston Spa (England).
OXYGEN. PART 1: PROPERTIES, HAZARDS, PREVENTIVE MEASURES
M. Chevalier et al 20 Apr. 1972 13 p refs Transl. into ENGLISH from Cahiers de Notes Documentaires: Securite et Hyg. du Travail (France), no. 56, 3d Quarter 1969 p 245-251
(NLL-CE-Trans-5847-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The hazards of using oxygen are considered. A number of accident cases are quoted demonstrating particular properties of the gas against which precautions must be taken. Some preventive measures are described. Author

N72-26093 National Lending Library for Science and Technology, Boston Spa (England).
STUDIES ON COUNTERCURRENT CONTINUOUS GAS CHROMATOGRAPHY
S. Araki et al Mar. 1972 15 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 74, no. 4, 1971 p 109-113
(NLL-RTS-6991) Avail: Natl. Lending Library, Boston Spa, Engl.: £ 1.30; 4 NLL photocopy coupons

A study was made of theoretical equations for obtaining the maximum sample, if it is assumed that each of the partition coefficients in a two-constituent system is constant up to the saturated vapor concentration in the gas phase. The relationship between theoretical stage height and the logarithm of the difference between reciprocals of partition coefficients in the two-constituent system was also considered. Theoretical equations for obtaining the number of overall gas phase transfer units are also discussed. Author

N72-26094 National Lending Library for Science and Technology, Boston Spa (England).
THE SEPARATION OF RIBONUCLEIC ACID ON POLYACRYLAMIDE GELS
Jerzy Wojcicki Apr. 1972 12 p refs Transl. into ENGLISH from Postepy Biochem (Warsaw), v. 16, no. 4, 1970 p 551-558
(NLL-RTS-6954) Avail: Natl. Lending Library, Boston Spa, Engl.: £ 1.10 or 4 NLL photocopy coupons

The electrophoretic separation of RNA in gels gives greater possibility of obtaining individual fractions than the chromatographic methods so far used or centrifuging in density gradients. Acting on the principle of a molecular sieve, electrophoresis in gels has made it possible to separate particles differing in size and form. Columnar electrophoresis in polyacrylamide gels proved itself a valuable method for separating proteins. Author

N72-26095 National Lending Library for Science and Technology, Boston Spa (England).
THE TIME DEPENDENCE OF THE DIELECTRIC LOSS FACTOR FOR CHLORINATED DIPHENYLS IN THE IONIC CONDUCTION RANGE
M. Beyer and J. Pautz 4 Apr. 1972 18 p refs Transl. into ENGLISH from Elektrotech. Z. (Berlin), v. 92, no. 7, 1971 p 395-400

(NLL-Z-387-(7384.33)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

When measuring the dielectric loss factor of chlorinated diphenyls a dependence of the measured values on time is often observed. The cause of this is found to be the effect of boundary layers on the electrodes which result from the pre-treatment of the measuring cell, and a reduction in charge carriers of the substance to be measured during the measurement. The variation of the loss factor with time occurs particularly when measuring cells are used in which the volume of the measuring gap is large compared with that of the whole filling. In the case where their gap volume is small compared with the whole filled volume, the time dependence of the loss factor is very small. Author

N72-26096 National Lending Library for Science and Technology, Boston Spa (England).
OSCILLATOR STRENGTHS FOR Ti 1 SPECTRA
V. K. Prokofev and T. A. Ratobylskaya May 1972 62 p refs
Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (USSR), v. 39, 1969 p 186-231
(NLL-RTS-7072) Avail: Natl. Lending Library, Boston Spa, Engl.: £ 5.00; 17 NLL photocopy coupons

Measurements and calculations of relative values of oscillator strengths in Ti I spectra are reviewed. A summary of recommended values for 737 lines belonging to 255 multiplets is presented. The formula for the transition from relative values given on the King scale to absolute values was determined. Author

N72-26097*# Houston Univ., Tex. Dept. of Physics.
THERMOMAGNETIC TORQUES IN POLYATOMIC GASES Final Progress Report, 1 Jul. 1971 - 29 Feb. 1972
A. F. Hildebrandt and C. T. Wood 14 Apr. 1972 7 p refs
(Grant NGR-44-005-122)
(NASA-CR-127063) Avail: NTIS HC $3.00 CSCL 07D

The application of the Scott effect to the dynamics of galactic and stellar rotation is investigated. Efforts were also made to improve the sensitivity and stability of torque measurements and understand the microscopic mechanism that causes the Scott effect. E.H.W.

N72-26098# National Bureau of Standards, Washington, D.C. Polymers Div.
STANDARD REFERENCE MATERIALS: COMPARISON OF ORIGINAL AND SUPPLEMENTAL SRM 705, NARROW MOLECULAR WEIGHT DISTRIBUTION POLYSTYRENE
Herman L. Wagner May 1972 31 p refs
(NBS-SP-260-33) Avail: SOD $0.35 as C13.10:260-33

Because the supply of the original batch of narrow molecular weight distribution polystyrene, SRM 705, is almost exhausted, another supply of polystyrene, reported to be from the same batch as the original was characterized to determine whether it is the same as the original as far as the properties listed on the certificate are concerned. No difference in molecular weight as measured by light scattering, osmometry, or gel-permeation chromatography could be found. The limiting viscosity numbers were also the same. It was also shown from solution viscosity measurements that pellet to pellet variation in molecular weight is negligible. Author

N72-26099# Bureau of Mines, Minneapolis, Minn. Twin Cities Metallurgy Research Center.
ACTIVITY PATTERNS IN THE CATALYTIC REDUCTION OF SO2 ON SOME TRANSITION ELEMENTS IN ALUMINA
L. A. Haas, T. H. McCormick, and S. E. Khalafalla 1972 17 p refs
(BM-RI-7647; LC-622.06173; TN23.U7) Avail: NTIS HC $3.00

Reduction of SO2 with CO was studied in an integral flow reactor at a nominal flow of 0.5 liter per minute. Reactant gas contained 3 percent SO2, 6 percent CO, and the balance He. Conversion of SO2 was determined for three different types of catalysts. The first consisted of 16 commercial catalysts used for various chemical syntheses. Only the commercial catalysts which contained transition metals in alumina removed more than 30 percent SO2 at temperatures below 510 C. Two other types of catalysts were prepared in the laboratory, by pelletizing equal amounts of powdered alumina and transition metal oxides or by impregnating commercial alumina tablets with transition metal ions. Cr and Fe in alumina were the two best catalysts. The observed results suggest that an intermediate (SCO) is formed by the interaction of surface metal sulfides and carbonyls. Alumina then catalyzes the interaction of SCO with SO2 to form the end products (sulfur and carbon dioxide). Over 80 percent SO2 was removed at 460 C with 2 grams alumina impregnated with 2.5 percent iron. Author

N72-26100*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
THERMOPHYSICAL PROPERTIES OF OXYGEN FROM THE FREEZING LIQUID LINE TO 600 R FOR PRESSURES TO 5000 PSIA
Robert D. McCarty and Lloyd A. Weber Jul. 1971 189 p refs
(NASA Order T-1813A)
(NASA-CR-127053; NBS-TN-384) Avail: NTIS; SOD $1.50 as C 13.46:384 CSCL 07D

Tables of thermophysical properties of oxygen are presented for temperatures from the melting line to 600 R for pressures to 5000 psia. The tables include, entropy, enthalpy, internal energy, density, volume, speed of sound, specific heat, thermal conductivity, viscosity, thermal diffusivity, Prandtl number and the dielectric constant for 79 isobars. Also included in the isobaric tables are quantities of special utility in heat transfer calculations. In addition to the isobaric tables, tables for the saturated vapor and liquid are given which include all of these properties, plus the surface tension. Tables for the P-T of the freezing liquid, index of refraction and the derived Joule-Thomson inversion curve are also presented. The specific heat of the saturated liquid is given in graphical form. A temperature-entropy chart and a Mollier diagram are also included. Author

N72-26101# Technische Hogeschool, Delft (Netherlands).
PHYSICAL ADSORPTION ON IONIC SOLIDS Ph.D. Thesis
Robert Hendrik VanDongen 1972 135 p refs
Avail: NTIS HC $8.75

Some general aspects of adsorption of gases on nonporous solids are outlined. A detailed discussion is given of the calculation of the adsorption potential (gas-solid interaction energy) by means of summation of the six-exp pair potential over all lattice points of the adsorbent crystal. The following adsorption systems were investigated: He, Ne, Ar, Kr, Xe, H2, N2, and CH4 on the basal plane of graphite and Ar, Kr, Xe and N2 on the cleavage planes of NaBr, KBr and CdBr2. The Fowler-Guggenheim equation for localized adsorption and the Hill-de Boer equation for mobile adsorption on a homogeneous surface are discussed. The case of ideal adsorption at higher temperatures is investigated. Multilayer extensions of the Hill-de Boer and the Fowler-Guggenheim adsorption equations are presented. The implications of surface heterogeneity are discussed. The theoretical adsorption models discussed are compared to experimental isotherms and isosteric heat curves of Ar on graphite, Ar, Kr, Xe and N2 on CdBr2, NaBr, and KBr. Author

N72-26102*# Scientific Translation Service, Santa Barbara, Calif.
QUANTITATIVE GAS ANALYSIS BY MASS SPECTROMETER. NO. 3: QUANTITATIVE ANALYSIS OF CARBON MONOXIDE AND NITROGEN
M. Hayakawa Washington NASA Jun. 1972 9 p refs
Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 74, 1953 p 752-754 Presented at the 1st Nippon Bunseki Kagakuhai Meeting, Oct. 1954
(Contract NASw-2035)
(NASA-TT-F-14322) Avail: NTIS HC $3.00 CSCL 07B

The problem of separating compounds with similar M/e using a mass spectrometer is discussed. One possible solution is to oxidize one of the components by chemical means. A method using copper oxide is described. Author

N72-26103*# California Univ., Berkeley. Lawrence Berkeley Lab.

THE SYNTHESIS OF STARCH FROM CARBON DIOXIDE USING ISOLUBILIZED STABILIZED ENZYMES

James A. Bassham, Lydia Bearden, Charles Wilke, Paul Carroad, George Mitra, and Richard Ige 9 Jun. 1972 85 p refs
(NASA Order A-68042A)
(NASA-CR-114460) Avail: NTIS HC $6.25 CSCL 07C

Systems for artificial manufacture of starch and for delineation of technological areas, and the rationale for studying them are considered. A discussion of the enzyme-catalyzed routes of synthesis available and a choice as to the most promising route are presented. A discussion of the enzymes involved, of enzyme insolubilization technology, and of possible engineering approaches, with examples in the form of model calculations for both reactors and separators, are also presented. Author

N72-26104# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Radiochemie.

PREPARATION OF ACTINIDE LANTHANIDE-NOBLE METAL (Pt, Pd, Ir, Rh) ALLOY PHASES BY COUPLED REDUCTION Ph.D. Thesis - Technische Hochschule, Karlsruhe

Bernhard Erdmann Oct. 1971 150 p refs In GERMAN
(KFK-1444) Avail: AEC Depository Libraries

The reduction of actinide oxides (A = Th to Cm) with highly purified hydrogen in the presence of noble metals (B = Pt, Pd, Ir, Rh)--the so-called coupled reduction--results in the formation of alloy phases of AB2, AB3 and AB5 compositions. In the course of the investigation the following 20 compounds were prepared for the first time: Pt2Am, Pt2Cm, Ir2Np, Ir2Am, Ir3Cm, and Rh2Cm, all with the cubic Cu2Mg-type structure; Pt3Pa and Pt3Np with the hexagonal Cd3Mg-and Ni3Ti-type structure, respectively, as well as Pd3Np, Pd3Am, Pd3Cm, Ir3Pa, Rh3Pa, Rh3Np, Rh3Am, and Rh3Cm with the order Cu3Au-type of structure; Pt5Pa with the cubic Ni5U-, Pt5Np with the orthorhombic Pt5Tm-, and Pt5Am- and Pt5Cm- with the orthorhombic Pt5Sm-type structure. Besides these above-mentioned alloy phases, several intermetallic phases of the lanthanide and actinide elements, as well as those of some representative and transition elements were obtained.
Author (NSA)

N72-26105# Frankford Arsenal, Philadelphia, Pa.

INFRARED DETERMINATION OF NITROGEN IN RAW NITROCELLULOSE AND NITROCELLULOSE CONTAINED IN PROPELLANTS ON A MACRO AND SEMIMICRO SCALE

George Norwitz and David E. Chasan Jan. 1972 20 p refs
(AD-738850; FA-T72-3-1) Avail: NTIS CSCL 07/3

The infrared procedure for the determination of nitrogen in raw nitrocellulose has been improved. In the original method, 0.31 to 0.32 grams of sample were dissolved in 45 ml of tetrahydrofuran, the solution weighed, and the infrared peak at 6.05 microns measured. The calibration curve was prepared by plotting absorbance against mg of nitrogen per gram of solution. The method has the disadvantage that the height of the peak is uniquely affected by the sample weight. The infrared method for nitrogen in nitrocellulose was extended to the semimicro scale by using a 30.0-mg sample and diluting to 5 ml in a volumetric flask. The infrared procedure has also been applied on a macro and semimicro scale to the direct determination of nitrogen in nitrocellulose after a methylene chloride extraction. The amounts of graphite and inorganic salts found in nitrocellulose-base propellants do not interfere with the latter method.
Author (GRA)

N72-26106# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

PHOTO-EQUILIBRIUM OF BARIUM

Gordon T. Best and Victor L. Corbin 30 Nov. 1971 38 p refs
(AF Proj. 7635)
(AD-739166; AFCRL-71-0600; AFCRL-ERP-377) Avail: NTIS CSCL 07/4

A model for numerical simulation of the solar pumping of a simple atomic system is constructed and compared with the exact analytical solution. The process is then extended to cover the more complex 5-level 5-transition barium ion term scheme and the 61-level 86-transition barium neutral term scheme. An advantage of the step-wise simulation is that in addition to yielding the equilibrium relative level populations and transition intensities, it also permits the dynamic grow-in to equilibrium to be studied. The neutral barium system has also been studied with the inclusion of photoionization from each of several metastable levels. Author (GRA)

N72-26107# Air Force Academy, Colo. Frank J. Seiler Research Lab.

THE STRUCTURE OF ALUMINUM CHLORIDE-SODIUM CHLORIDE MELTS

Armand A. Fannin, Jr., Lowell A. King, and David W. Seegmiller Oct. 1971 42 p refs Revised
(AF Proj. 7903; AF Proj. 7903)
(AD-739353; SRL-TR-71-0018-Rev) Avail: NTIS CSCL 07/4

Equilibrium constants were calculated for reactions governing the species present at 175 C in molten mixtures of aluminum chloride and sodium chloride. The equilibria postulated pertain to formation of the complex ions AlCl4(-), Al2Cl7(-), and Al3Cl10(-) from Cl(-), AlCl3, and Al2Cl7(-), and Al3Cl8. Measurements were made throughout the concentration range N = 0.498 to N = 0.71. The possibilities of using these concentration cells as high density batteries are considered. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N72-26108 National Lending Library for Science and Technology, Boston Spa (England).

DIGITAL BASEBAND TRANSMISSION ON COAXIAL CABLES

H. W. Wellhausen 20 Apr. 1972 48 p refs Transl. into ENGLISH from Der Fernmelde-Ingenieur (West Germany), v. 26, no. 1, Jan. 1972 p 1-35
(NLL-Trans-2845-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 5 NLL photocopy coupons

An attempt is made to obtain optimizing quantities for the digital baseband transmission on coaxial cables by means of an analytical calculation. Under certain conditions a transcendental function is determined as approximation formula which comprises all essential quantities of the digital signal transmission. With the aid of this formula it is possible to obtain important information on the three conventional types of coaxial cables and on various types of signals. The investigated signals were b-level and pseudo signals. From the theoretical point of view neither the binary nor the analog type of transmission are optimally suited for coaxial cables. It has become apparent that there is an optimum between these two extreme cases. For the signals investigated it is to be found at 32 and 63 amplitude levels, respectively. Author

N72-26109 National Lending Library for Science and Technology, Boston Spa (England).

INTEGRAL EVALUATION OF THE QUALITY OF TELEVISION IMAGES

M. V. Antipin 28 Feb. 1972 81 p refs Transl. into ENGLISH

from report of USSR Acad. of Sci., Science Publishing House, Leningrad, 1970
(NLL-Trans-2815-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 8 NLL photocopy coupons

The problem of standardizing the subjective evaluation of the quality of television images is considered. The results are given of investigations into the sensory characteristics of the visual analyser, so as to obtain a relation between the physical parameters of the image and the subjective evaluation of its reproduction quality. The stochastic response of the visual analyzer is described and the sensory characteristics are given for the linear parameters of the television system and the fluctuation noise parameters. Author

N72-26110 National Lending Library for Science and Technology, Boston Spa (England).
ERROR RATE MEASUREMENTS
H. W. Wellhausen and D. Martin 20 Apr. 1972 12 p refs
Transl. into ENGLISH from NTZ-Nachtech. Z. (Brunswick), v. 24, no. 11, 1971 p 553-557
(NLL-Trans-2848-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The important parameters for the definition of the bit error rate of digital transmission lines are described. It is proposed that the bit error rate should refer to a measurement duration of 60 minutes. Moreover it is suggested that only the worst value of bit error rate which is ascertained during a certain measurement period (eg 1 month) be considered as a criterion of transmission quality. The bit error rate must be related to a defined line length, which preferably should be part of a reference circuit still to be determined. The main parts of a measuring equipment are discussed, along with its essential requirements and some measurement results. Author

N72-26111 Ohio State Univ., Columbus.
VHF COMMUNICATIONS REPEATERS USING CROSSED DIPOLE ANTENNAS Ph.D. Thesis
Leonard Martin Schwab 1971 147 p
Avail: Univ. Microfilms Order No. 71-27555

A crossed dipole repeater consisting of orthogonally oriented receiving and transmitting dipole antennas and a very high frequency transistorized amplifier is considered. A system model using a composite of equivalent two-ports for the electromagnetic (crossed dipole pair) and electronic (amplifier) portions is derived. The two-port impedance data characterizing the crossed dipole pair are computed using the piecewise sinusoidal multi-segment reaction technique for the cases of the orthogonal dipole geometry and angular perturbations for the orthogonal relationship. Stability, gain, and matching considerations relating to VHF bandpass amplifiers using contemporary low power drain transistors are presented together with graphical aids useful for design. Dissert. Abstr.

N72-26112 Newark Coll. of Engineering, N.J.
SIDELOBE SUPPRESSION IN CHIRP RADAR SYSTEMS Ph.D. Thesis
Stephen N. Honickman 1971 188 p
Avail: Univ. Microfilms Order No. 71-30013

Chirp radar systems which achieve greater target resolution for a given detectable range by frequency modulating the carrier frequency of the transmitted pulse are considered. The waveform distortion introduced by those systems which employ time gating creates unwanted range sidelobes in the received signal since a mismatch now exists between transmitter and receiver. A derivation of the receiver response and a method for sidelobe suppression is reported. The results of such a derivation clearly indicate that the received waveform possesses an F-M structure. The new technique requires modification of the known received signal to achieve a desired waveshape and a physically realizable sidelobe suppression filter. Dissert. Abstr.

N72-26113 Polytechnic Inst. of Brooklyn, N.Y.
WAVE PROPAGATION IN RANDOM MEDIA WITH STRATIFIED BACKGROUNDS Ph.D. Thesis
George Philip Bein 1971 267 p
Avail: Univ. Microfilms Order No. 71-29029

Quasi-monochromatic, scalar wave propagation in a random medium having an average dielectric constant (or refractive index) that is a function of position in the medium is considered. The inhomogeneous background is considered to be lane stratified and both one dimensional and three dimensional fluctuations are included. For slabs having slowly-varying background, WKB methods are used to obtain expressions for the random transmission coefficient, for both large scale and small scale fluctuations. In addition, the energy reflected by the random slab is calculated via distorted wave born and phenomenological approaches. Dissert. Abstr.

N72-26114 British Broadcasting Corp., Kingswood (England). Research Dept.
PULSE-CODE MODULATION FOR HIGH-QUALITY SOUND-SIGNAL DISTRIBUTION: PROTECTION AGAINST DIGIT ERRORS
J. R. Chew and M. E. B. Moffat 1972 14 p refs
(BBC-1972/18; EL-64) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Techniques for protecting a high quality sound signal pulse code modulation distribution system against bit errors are compared. The criteria for choosing a technique suitable for a particular PCM transmission system are discussed. The optimum choice for binary PCM transmission of the sound signals via SHF radio links is shown to comprise a combination of single bit parity checking of the first five most significant bits in each channel word, with error concealment by zero-order extrapolation high frequency de-emphasis. Author

N72-26115 British Broadcasting Corp., Kingswood (England). Research Dept.
UHF RELAY STATIONS: DISTRIBUTION TRANSFORMERS FOR USE WITH THE STANDARD HORIZONTALLY POLARISED RBL AERIAL
G. H. Millard 1972 9 p refs
(BBC-1972/16; RA-99) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The design and performance are given of two printed circuit distribution transformers for use with the standard horizontally-polarized re-broadcast link (RBL) trough aerial. Author

N72-26116 British Broadcasting Corp., Kingswood (England). Engineering Div.
A UHF AERIAL FOR ELLIPTICAL POLARISATION
G. H. Millard, J. H. Moore, and N. F. Spring 1972 8 p refs
(BBC-1972/17; RA-100) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A special aerial was made for tests of a proposal to reduce tidal fading. It consisted of a vertically polarized printed panel aerial modified by the addition of a single horizontal dipole and fed with current of appropriate amplitude and phase. Author

N72-26117*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
TELEVISION DATA DISPLAY SYSTEM (TDDS)
K. Sendler 3 Jan. 1972 50 p
(NASA-TM-X-68461; KSC-GP-965) Avail: NTIS HC $4.50 CSCL 17B

A television data display system at KSC is described which displays computer processed data derived from space vehicle launch and prelaunch tests. The general system capabilities and technical features are discussed in separate sections under the headings of: (1) operational use, (2) system description, (3) computer programs, (4) computer hardware, and (5) adaptability. D.L.G.

N72-26118*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
THE GENREL TELETYPE PACKAGE
Brian K. Reid May 1971 45 p
(Contract NAS9-5886)
(NASA-CR-127055; TR-71-108) Avail: NTIS HC $4.25 CSCL 17B

A collection is presented of programs designed specifically for use on a teletype (or similar conversational time-sharing terminal). The criteria for designing these programs are given, and a description of each program is included. F.O.S.

N72-26119*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ASSESSMENT AND CONTROL OF SPACECRAFT ELECTROMAGNETIC INTERFERENCE NASA Space Vehicle Design Criteria (Environment)
Jun. 1972 37 p refs
(NASA-SP-8092) Avail: NTIS HC $3.00 CSCL 20C

Design criteria are presented to provide guidance in assessing electromagnetic interference from onboard sources and establishing requisite control in spacecraft design, development, and testing. A comprehensive state-of-the-art review is given which covers flight experience, sources and transmission of electromagnetic interference, susceptible equipment, design procedure, control techniques, and test methods. D.L.G.

N72-26120*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
A UNIQUE MODULATION SYSTEM FOR TWO CHANNEL DATA TRANSMISSION
Bruce Thorne Melrose 15 May 1972 53 p refs
(Grant NGL-39-009-015)
(NASA-CR-127039; PSU-IRL-SCI-392(E)) Avail: NTIS HC $4.75 CSCL 09F

A simple low cost system is reported for the telemetry of information from meteorological rocket payloads including parachute borne systems. It uses S- or L-band microwave links with low cost oscillator type transmitters. An extension of this system to transmit two channels of data simultaneously by standard time and frequency multiplexing techniques as a sampled pulse is described. One channel is represented by the pulse repetition rate while the other channel is represented by the instantaneous duty cycle of the pulse train. Author

N72-26121# Joint Publications Research Service, Arlington, Va.
REQUIREMENTS FOR PARAMETERS OF OPTO-ACOUSTICAL PROCESSOR OF SIGNALS OF PHASED ANTENNA ARRAYS
B. V. Panasko 9 Jun. 1972 8 p ref Transl. into ENGLISH from Izv. Vyssh. Zaved., Radioelektron. (Kiev), v. 15, no. 1, 1972
(JPRS-56221) Avail: NTIS HC $3.00

An analysis of the distribution of the photic field is presented for the output of an opto-acoustical processor of signals of a phased antenna array with a time separation of the signals from antenna elements. Author

N72-26122# Joint Publications Research Service, Arlington, Va.
ANTENNA RADIATION PATTERNS
9 Jun. 1972 29 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Kiev), v. 11, no. 5, 1968 p 476-484 and 548-552
(JPRS-56219) Avail: NTIS HC $3.50

A consideration of the angle-frequency sensitivity of antennas with anomalous dispersion of transmission lines, and an analysis of an automatic radiation pattern measuring system are presented. For individual titles, see N72-26123 through N72-26125.

N72-26123# Joint Publications Research Service, Arlington, Va.
THE ANGLE-FREQUENCY SENSITIVITY OF ANTENNAS WITH ANOMALOUS DISPERSION OF TRANSMISSION LINES
A. I. Ardabyevskiy and R. A. Granovskaya *In its* Antenna Radiation Patterns 9 Jun. 1972 p 1-14 refs (See N72-26122 17-07)
Avail: NTIS HC $3.50

The use of transmission systems with anomalous dispersion for a reduction in the angle-frequency sensitivity in linear radiator arrays with parallel and series excitation circuits is considered. The requirements for transmission systems with broadband linear array are discussed along with delay systems with anomalous dispersion. It is concluded that transmission systems with anomalous dispersion in an arrangement with series excitation have no advantage over a regular rectangular waveguide because the angle-frequency sensitivity of a linear radiator array when using such systems is higher (four to five times) than when using the waveguide. F.O.S.

N72-26124# Joint Publications Research Service, Arlington, Va.
ANALYSIS OF AUTOMATIC RADIATION PATTERN MEASURING SYSTEM
A. I. Gudzenko and B. V. Kogalenko *In its* Antenna Radiation Patterns 9 Jun. 1972 p 15-18 refs (See N72-26122 17-07)
Avail: NTIS HC $3.50

The generalized circuits of automatic devices for measuring and recording radiation patterns are briefly analyzed. F.O.S.

N72-26125# Joint Publications Research Service, Arlington, Va.
REDUCTION OF ANGLE-FREQUENCY OF AN ARRAY BY PRISM
A. I. Ardabyevskiy, D. I. Voskresenskiy, and T. A. Langfang *In its* Antenna Radiation Patterns 9 Jun. 1972 p 19-26 refs (See N72-26122 17-07)
Avail: NTIS HC $3.50

Reducing the angle-frequency sensitivity by superimposing a dispersion or nondispersion prism on the radiation array was studied. It is concluded that a nondispersion prism reduces the angle-frequency sensitivity but does not give full compensation. Full compensation is obtained by a nondispersion prism only in the case where the feeder in a parallel power supply arrangement has anomalous dispersion, or by means of a dispersion prism when its dispersion is normal. F.O.S.

N72-26126# Lockheed Missiles and Space Co., Palo Alto, Calif.
RECORDING OF LOW FREQUENCY RADIATION AND SIGNALS ON THE INTERKOSMOS-3
L. V. Vernova, Ia. Voita, F. Irzhichek, V. V. Korobovkin, V. I. Lebedeva, Ia. I. Likhter, Ia. P. Sobolev, L. A. Timofeeva, and P. Triska 1972 13 p refs Transl. into ENGLISH from Kosmich. Issled., Akad. Nauk SSSR (Moscow), v. 10, no. 1, 1972 p 82-91
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago Ill. 60616

A low frequency receiver and a USW-FM transmitter to relay the wideband signals recorded by the receiver to the ground station were used on the Intercosmos-3 to record low frequency electromagnetic waves and signals. The characteristics of the apparatus are described in detail. Examples are presented of the diverse low frequency signals received on the satellite: Partially dispersed, sub-protonospheric, proton whistlers, and some other signals. A description is given of the properties of these signals and of the interpretation of certain types. Author

N72-26127# Lockheed Missiles and Space Co., Palo Alto, Calif.
PECULIARITIES OF THE CONSTRUCTION AND FUNDAMENTAL PARAMETERS OF THE LUNOKHOD-1 TELEVISION SYSTEMS
A. S. Selivanov, V. M. Govorov, V. V. Zasetskii, and V. A. Timokhin 1971 12 p refs Transl. into ENGLISH from the book "Peredvizhenaia Laboratoriia na Lune Lunokhod-1" Moscow, AN SSSR Press, 1971 p 55-64
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The operating principle and fundamental parameters of the moon rover television systems were selected in order to solve the following problems: control of moon rover motion, investigation of geomorphological and topographic phenomena of the lunar surface, and observation of earth and sun for navigational purposes. The moon rover television complex was constructed from a television system having transmitting cameras with a mechanical optic panoramic sweep for the investigation of structure and topographical survey of the lunar surface as well as for star observations, while the electronic system of a small frame television was elected to control the moon rover motion.
G.G.

N72-26128# Sandia Labs., Albuquerque, N.Mex.
TELEMETRY REPORT: HAVE SINEW-1 FLIGHT TEST
D. W. Berst, C. M. Warthen, and D. A. Lloyd Jan. 1972 71 p
Sponsored by AEC
(SC-RR-710868) Avail: NTIS

The HAVE SINEW flight test was conducted to provide information relating to data recording techniques for reentry environments simulating aborted rocket launches. The system was required to collect motion and temperature data during the supersonic and the subsonic phases of the reentry trajectory of the instrumented capsule. An additional objective was to test a method for recovering radioisotopic material. The flight trajectory consisted of a reentry velocity of 19,700 fps and a reentry angle of -41.5 degrees. The heating environment from this trajectory subjected the POCO graphite heat shield to an approximate peak temperature of 3400 F, depending on the motion of the capsule.
Author

N72-26129# Technische Hogeschool, Eindhoven (Netherlands).
A MATHEMATICAL THEORY CONNECTING SCATTERING AND DIFFRACTION PHENOMENA, INCLUDING BRAGG-TYPE INTERFERENCES
H. Bremmer Dec. 1971 69 p refs
(TH-71-E-26) Avail: NTIS HC $5.50

The usefulness of expressions containing differential operators is shown for special applications to scattering and diffraction phenomena, involving a slab containing a slightly inhomogeneous medium. The refractive index of the medium is given as a function of the three space variables and time. The theory of contributions generated by an obliquely incident wave and due to a number of scatterings is developed with the aid of symbolic expressions depending on partial derivatives with respect to the space-time variables. The two dimensional Laplace operator of the refractive index distribution in planes parallel to the boundaries is shown to play a dominant role. A resulting representation of the Born approximation shows the transition from the scattering behavior of a thin slab to the predominantly diffracting behavior of a thick slab. The main wave equations generated are related by an extension of Bragg's relation. Author (ESRO)

N72-26130# Helsinki Univ. (Finland). Radio Lab.
WAVE NORMAL AND RAY PROPAGATION IN LOSSLESS POSITIVE BIANISOTROPIC MEDIA
Ismo V. Lindell 6 Mar. 1972 22 p refs Submitted for publication
(Rept-S-46) Avail: NTIS

Wave normal and ray propagation associated with a propagating electromagnetic discontinuity in lossless positive bianisotropic media are considered. Wave-normal and ray equations of fourth degree are derived, and duality of the equations is discussed. Solutions of a special bianisotropic medium are considered. It is proven that for a general lossless positive bianisotropic medium, there always exist two characteristic wave normal and ray surfaces. Transformation formulas for the constitutive dyadics of a moving bianisotropic medium are derived. It is also proven that if a lossless positive bianisotropic medium is set in a uniform motion, the medium is lossless positive if and only if the velocity is smaller than the smallest characteristic ray and wave normal velocities.
Author (ESRO)

N72-26131# Helsinki Univ. (Finland). Radio Lab.
RADIO LABORATORY Annual Report. Academic Year 1970-1971
M. Tiuri 1971 26 p refs
(Rept-S-48) Avail: NTIS HC $3.50

Besides the normal staff situation and list of publications, reports on research in the following are given: electromagnetic theory, waves and antennas; microwave theory, techniques, equipment and applications; and radio instrumentation.
Author (ESRO)

N72-26132# Helsinki Univ. (Finland). Radio Lab.
PROGRESS IN RADIO SCIENCE IN FINLAND 1969-1971
M. Tiuri, ed. and S. Halme, ed. Jan. 1972 25 p refs
(Rept-S-49) Avail: NTIS HC $3.25

Finnish progress in radio science is reviewed. Among the topics summarized are radio measurements, ionospheric disturbances, auroral pulsations, radio astronomy, circuit theory, and semiconductor materials. Extensive bibliographies of Finnish works are appended to each topic. Author (ESRO)

N72-26133# Naval Electronics Lab. Center, San Diego, Calif.
ANALYSIS OF A MULTIMODE PROPAGATION CONCEPT FOR PREDICTING VLF SIGNAL STRENGTHS AT NIGHT Research and Development Report, Jan. 1969 - Aug. 1971
David G. Morfitt 9 Dec. 1971 64 p refs
(NELC Proj. M208)
(AD-738846; NELC-TR-1798) Avail: NTIS CSCL 20/14

It is determined that VLF signal levels can be predicted by the multimode propagation concept with pronounced accuracy along a radial path for which the ionospheric parameters have been previously determined. With increasing deviation of radial bearing angle from this path, the accuracy of predictions for other propagation radials is found to decrease. Author (GRA)

N72-26134# Boeing Co., Seattle, Wash. Aerospace Group.
ELECTRONIC SIGNAL PROCESSING TECHNIQUES. PHASE 3: NONDESTRUCTIVE TESTING Final Report, 15 Dec. 1970 - 15 Dec. 1971
James C. Kennedy and Wayne E. Woodmansee Jan. 1972 77 p refs
(Contract DAAA25-69-C-0206; ARPA Order 1246; DA Proj. W2Z-1246-F-1-F-6)
(AD-738567; D180-10589-3) Avail: NTIS CSCL 14/2

Correlation methods have been used to reduce surface roughness noise in eddy current and ultrasonic flaw detection systems. Titanium plates containing artificial flaws in the form of small drill holes and EDM slots have been ultrasonically inspected using multi-transducer techniques. It has been shown that cross-correlations formed between the various signals available significantly reduce the limiting background noise. A steel plate containing EDM slots has been inspected with an eddy current probe which produces four separate flaw detection signals. It has been shown that a quadruple product formed from these four signals reduces the background noise level. Initial tests indicate that coherent optical processing techniques are not likely to significantly enhance the clarity of marginal flaw signals on X-ray radiographs. Author (GRA)

N72-26135# White Sands Missile Range, N.Mex. Instrumentation Development Div.
PHASED ARRAY INSTRUMENTATION RADAR (PAIR) DESIGN ANALYSIS
Rodolfo L. Gonzales Jul. 1971 142 p refs
(DA Proj. 1U2-65302-D-240)
(AD-738578; STEWS-ID-I-71-2) Avail: NTIS CSCL 17/9

The analysis was performed under WSMR Task A-16, Multiple Tracking System, primarily to document basic performance relationships, and approaches to a phased array instrumentation tracking radar. Included are general approaches to phased arrays, sensitivity analysis, power handling computations, coverage with respect to the WSMR boundaries, cost trend analysis, basic radar errors, tracking accuracy as function of target dynamics and number of targets, presentation of actual tracking data from an existing phased array radar, delineation of system processor words, phased array radar reliability estimates, a set of preliminary specifications, establishment of testing priorities, and a set of test plans. Author (GRA)

N72-26136# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
ON THE EFFECTS OF UNDESIRED SIGNAL INTERFERENCES TO A COHERENT DIGITAL CARRIER
Joseph M. Aein Feb. 1972 87 p refs
(AD-738593; RP-P-812; IDA/HQ-71-13729) Avail: NTIS CSCL 09/4

The paper investigates the problem of estimating the effects of interference to a coherent PSK digital carrier. The principle tool utilized is the Cramer-Chernoff bound with upper bound approximations having the form of an algebraic factor times an exponential. The argument of the exponential is an equivalent SNR. This SNR can be calculated by allocating the effects of the larger interferers to an equivalent coherent canceling sine wave and the remaining interferers to an equivalent source of thermal noise. Subject to an envelope constraint, any allocation of the interferers between a canceling sine wave and thermal noise is allowed. Therefore, characterizing that allocation of interferers which produces a large equivalent SNR is of great interest. The principle contribution of this paper resides in the ability to characterize this choice with relatively simple ratios of carrier, interference, and actual thermal noise powers. Author (GRA)

N72-26137# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
PENNSYLVANIA-PRINCETON ARMY AVIONICS RESEARCH PROGRAM. RADAR SYSTEMS TASK Final Technical Report
Raymond S. Berkowitz Feb. 1972 24 p refs
(Contract DA-28-043-AMC-02411(E); DA Proj. 1H1-62202-A-219)
(AD-738596; Rept-72-18; ECOM-02411-27) Avail: NTIS CSCL 17/9

The general objective was to determine the applicability and feasibility of airborne radar systems and related equipments for Army helicopter use. The work was divided into three subtasks: Multi-purpose Radar Studies; Specialized Radar Data Processing Techniques; and Laser Radar Applications. GRA

N72-26138# Defense Documentation Center, Alexandria, Va.
COLOR TELEVISION Report Bibliography, Aug. 1960 - Oct. 1971
Mar. 1972 73 p refs
(AD-738600; DDC-TAS-72-3) Avail: NTIS CSCL 17/2

The report presents color display systems and their technical advancements. The current and experimental display systems being developed are also included along with the characteristics of various state-of-the art color tubes. Methods of wave front reconstruction of images in color from black and white holograms are discussed. A new approach to instruction, by the use of color television, is explored. Corporate Author-Monitoring Agency, Subject, Title, and Personal Author Indexes are included. Author (GRA)

N72-26139# Naval Postgraduate School, Monterey, Calif.
HYBRID SONAR SIMULATION M.S. Thesis
Mauro Cesar Rodrigues Pereira Sep. 1971 187 p refs
(AD-738908) Avail: NTIS CSCL 17/1

The purpose of this study was the development of a computer system for research and instruction in signal processing for underwater sound applications. The nature of the problem demanded the use of three computers interfaced by hardware and software to operate as a single system. A general purpose analog computer was employed to generate signals and noise, provide analog processing and filtering and to allow the input of actual signals collected in the field. A general purpose digital computer provided for the examination of existing processing methods and for the investigation of new techniques. A high level graphics computer was used for data display and as the system control station which provided for a high degree of human operator processing and interaction. Author (GRA)

N72-26140# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SPATIAL CORRELATION OF AURORAL RADIO ABSORPTION
Kurt Toman, Raymond J. Cormier, and John J. Corbett 17 Sep. 1971 20 p refs Presented at AGARD-NATO Wave Propagation Panel Specialists Meeting on Radar Propagation in the Arctic, Lindau/Harz, 13-17 Sep. 1971
(AF Proj. 5631)
(AD-739168; AFCRL-71-0488; AFCRL-ERP-372) Avail: NTIS CSCL 04/1

The temporal behavior of auroral radio absorption measured with riometers at medium and high latitudes displays complex patterns that differ spatially. These differences may be limited to a time-displacement of otherwise similar absorption patterns, indicating a movement which could be interpreted in terms of a structured, locally enhanced, precipitating, energetic particle stream that moves over a geographic area while preserving its structure. In order to assess numerically the spatial coherence of auroral radio absorption, a correlation study of such absorption patterns has been undertaken. Data were recorded by more than eight riometer stations during five days of varying activity containing the magnetic storm of 18 April 1965. With a day as the sample size, the results of this study provide a view of the spatial coherence of auroral absorption which could be exploited further for the prediction of ionospheric propagation in the arctic. Author (GRA)

N72-26141# Naval Postgraduate School, Monterey, Calif.
A DIGITAL COMPUTER PROGRAM FOR DETERMINING THE PULSE TO PULSE RADAR CROSS SECTION ON A DYNAMIC TARGET M.S. Thesis
Frederick Elwood Meyett, Jr. Jun. 1971 60 p refs
(AD-738920) Avail: NTIS CSCL 17/9

The paper describes the design and use of SIGMA, a computer program for the calculation of radar cross section of a dynamic target on a pulse to pulse basis, using the MK 25 Fire Control Radar. The program is written specifically for use on the Scientific Data Systems 9300 computer in FORTRAN IV, but is readily adapted to other data processing systems. The input data base is composed of magnetic tape recordings of instrumented radar range and signal strength. Outputs include target cross section and range, and mean cross section and range in printed tabular listing, in graphical form, and on digital magnetic tape. Author (GRA)

N72-26142# Naval Postgraduate School, Monterey, Calif.
THE IMPLEMENTATION OF A DYNAMIC RADAR CROSS SECTION MEASURING TECHNIQUE M.S. Thesis
Forrest Truesdell Cunningham Jun. 1971 75 p refs
(AD-738909) Avail: NTIS CSCL 17/9

The instrumentation of a Mk-25 Radar Fire Control System to perform radar cross section measurements of airborne targets on a pulse-to-pulse basis is described. Instrumented signals available within the radar are conditioned, recorded on magnetic tape, and forwarded for digital computer processing. A discussion of this radar cross-section measurement method, a description of its implementation and assessment of its validity are presented. Author (GRA)

N72-26143# Naval Postgraduate School, Monterey, Calif.
ON SURVIVABILITY OF COMMUNICATION NETWORKS M.S. Thesis
Seyfettin Enginler Dec. 1971 61 p refs

(AD-738912) Avail: NTIS CSCL 17/2

The probability of survival of a communication network is defined as the probability that there exist at least one path between any pair of stations within the network. In this thesis, four methods for the calculation of the probability of survival of the network, which is under enemy attack, are presented. The first two methods deal with random networks whose links have finite and identical probability of survival, while the third and fourth methods are based on the min-cut max-flow theorem. Author (GRA)

N72-26144# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

TRANSMISSION OF ELECTROMAGNETIC WAVES THROUGH A TIME VARYING DIELECTRIC LAYER

Ronald L. Fante 7 Jan. 1972 21 p refs
(AF Proj. 4642)
(AD-739161; AFCRL-72-0044; AFCRL-PSRP-471) Avail: NTIS CSCL 20/14

Expressions are obtained for the electromagnetic fields transmitted through a time-varying dielectric layer when a plane wave is incident normally upon one interface. Solutions are obtained for the case when the dielectric constant is changed in a stepwise fashion, and also for the case when the dielectric constant varies slowly and continuously. It is found that the inclusion of the boundary effects gives rise to frequency components in the transmitted signal which were not predicted by previous theories. Author (GRA)

N72-26145# Army Materiel Systems Analysis Agency, Aberdeen Proving Ground, Md.

THE ENHANCEMENT OF ELECTRONICS RELIABILITY THROUGH THE USE OF TRANSCONDUCTANCE EFFICIENCY

Keats A. Pullen, Jr. Jan. 1972 46 p refs
(RDT/E Proj. 1-P-765801-MN-11)
(AD-738535; AMSAA-TM-123) Avail: NTIS CSCL 09/5

Solid-state active devices are basically transconductance controlled; their characteristics can be expressed by the Fermi parameter and a transconductance efficiency factor. The report develops the theoretical basis for the efficiency factor. The report also indicates how the efficiency factor may be used to evaluate the operating conditions for active devices, select the best ones for particular purposes, and increase the reliability of their circuits. Comparative design calculations are given in examples to show how electrical stability and resistance to radiation damage and destructive thermal environments can be enhanced by using otherwise unobservable parameters, the properties of which are disclosed in the analytical discussion. Author (GRA)

N72-26146# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.

RADIATION, PROPAGATION, AND SCATTERING OF ELECTROMAGNETIC WAVES IN IONIZED MEDIA Final Report, 1 Apr. 1967 - 31 Jan. 1972

David K. Cheng 31 Jan. 1972 5 p refs
(Grant DA-ARO(D)-31-124-G907)
(AD-738557; AROD-6886:19-E) Avail: NTIS CSCL 20/14

The report constitutes a brief summary of the more important results of a project whose objective was to make theoretical studies of the radiation, propagation, and scattering properties of electromagnetic waves in ionized media. Particular attention was to be paid to the effects of medium anisotropy, inhomogeneity, and motion. Author (GRA)

N72-26147# Naval Postgraduate School, Monterey, Calif.

CONTROLLING OF RANGE GATED MTI RADAR WITH DIGITAL TECHNIQUES M.S. Thesis

John Warren Millard Jun. 1971 47 p refs
(AD-738894) Avail: NTIS CSCL 17/9

The timing and gating circuitry necessary for twenty channels of range-gated MTI radar was constructed. By the incorporation of a variable delay in the commencement of the range-gate sampling interval, it was possible to extend the effective range over which the gates operated. The use of digital techniques with integrated circuits provided a means by which the twenty channels may easily be extended to any number required for a particular radar application. Performance of the circuitry was demonstrated in conjunction with a typical channel of range-gated MTI radar. Author (GRA)

N72-26148# Naval Postgraduate School, Monterey, Calif. Dept. of Electrical Engineering.

ADAPTATION OF THE AN/GPA-98A COUNTERMEASURES SIGNALS SIMULATOR FOR USE WITH THE AN/UPS-1 RADAR SET M.S. Thesis

Jack Ulrich Klass Sep. 1971 54 p refs
(AD-738877) Avail: NTIS CSCL 17/4

The AN/GPA-98A countermeasures signals simulator is intended for use with Air Force radars to provide simulated electronic countermeasures signals for radar operator training in an ECM environment. It is capable of simulating two independent aircraft targets with associated ECM -- pulse jamming, chaff, and high duty cycle AM/FM jamming. The purpose of the study was to determine the modifications to adapt the simulator for use with the AN/UPS-1 air-search radar located at the Naval Postgraduate School radar laboratory. Author (GRA)

N72-26149# Naval Underwater Systems Center, Newport, R.I. Computer Lab.

A NUMERICAL INTEGRATION IN PARAMETRIC SONAR RESEARCH

Marvin Goldstein 21 Oct. 1971 11 p refs
(AD-738479; NUSC-TM-PA4-268-71) Avail: NTIS CSCL 17/1

Mellen and Moffett discussed model for parametric sonar radiator design with respect to both absorption and saturation limits in either the near or far field. This technical memorandum analyzes a numerical integration performed by the author from which Mellen and Moffett derived families of curves in their paper for the prediction of parametric source level efficiency versus downshift ratio and primary absorption. Author (GRA)

N72-26150# Defense Dept., Washington, D.C.

THEORY OF TRANSMITTING DISCRETE MESSAGES

Lev Matveevich Fink and V. A. Smirnov, ed. 25 Feb. 1971 595 p refs Transl. into ENGLISH of the book "Teoriyaperedachi Diskretnykh Soobshchenii" Moscow, 2d ed. revised
(AD-738890) Avail: NTIS CSCL 09/4

Designing optimal communication systems with given channel characteristics is considered and parameters of systems which differ to one degree or another from the optimal are described. The values of potential resistance to interference of various signal systems when transmitting in communication channels with constant and variable parameters are found. Expressions for the carrying capacity of such channels are presented. A great deal of attention is devoted to evaluating the differences between actual apparatus circuits and ideal circuits. Recommendations are given for selecting optimal signal systems and optimal methods of reception in light of the properties of channels and the interference acting upon them. Author (GRA)

N72-26151# Ross Telecommunications Engineering Corp., Washington, D.C.

ANALYSIS OF EARTH STATION SITING FOR THE PROPOSED DOMESTIC SATELLITE SYSTEMS Final Report

James P. Fitzgerald, Charles E. Sampson, and Richard Zitzmann 4 Feb. 1972 119 p refs
(Contract OTP-SE-72-104)
(PB-207396) Avail: NTIS HC $3.00 CSCL 17B

The feasibility of siting the domestic satellite earth stations as proposed by the applicants is examined. It concludes that undue interference will not result from the proposed sitings, but that some sites should be reconsidered due to off-path scatter coordination requirements. GRA

N72-26152# Office of Telecommunications, Boulder, Colo. Policy Support Div.
A GENERAL ANALYSIS OF DOMESTIC SATELLITE ORBIT/SPECTRUM UTILIZATION
Dale Hatfield 13 Dec. 1971 38 p refs
(PB-207397) Avail: NTIS HC $3.00 CSCL 17B

The geostationary orbit/spectrum utilization of the U.S. Domestic Communication Satellite System applications is discussed. It provides information for considering the scarcity of the orbit/spectrum resource in DOMSAT policy recommendations. Author (GRA)

N72-26153# Stanford Research Inst., Menlo Park, Calif.
ECONOMIC VIABILITY OF THE PROPOSED UNITED STATES COMMUNICATIONS SATELLITE SYSTEMS
Daniel S. Allan, John L. Bossert, and Lloyd I. Krause Oct. 1971 148 p refs
(Contract OTP-SE-72-103)
(PB-207398) Avail: NTIS HC $3.00 CSCL 17B

The potential outcomes of a policy of open entry into the domestic communications satellite industry is examined. It consists of an analysis based on demand, cost, technical, and performance data contained in the applications to the FCC. GRA

N72-26154# Computer Sciences Corp., Paramus, N.J.
FREQUENCY ASSIGNMENT TECHNIQUES FOR MICROWAVE SYSTEMS, PHASE 2 Final Report
Feb. 1972 196 p
(Contract FCC-RC-10090)
(PB-207536; CSC-72-698; FCC-OCE-72-Ph-2) Avail: NTIS HC $3.00 CSCL 17B

Phase II of a two part study of frequency assignment techniques for microwave radio systems initiated by the FCC is reported. Phase I analyzed current utilization and frequency assignment techniques, and made recommendations for more efficient use of the spectrum. Phase II examines and analyzes the results of Phase I to determine the mechanics of data gathering, identification of specific data to be gathered, and how the data should be stored, processed and analyzed to achieve the stated objective of more effective use of the microwave frequencies available to the non-government fixed services. Author (GRA)

N72-26724*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE DIRECTIONALITY OF METEORIC PROPAGATION OF RADIO WAVES
R. A. Kurganov *In its* Meteoric Propagation of Radio Waves May 1972 p 73-94 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 20N

N72-26726*# Techtran Corp., Glen Burnie, Md.
A METHOD OF DETERMINING WIND CHARACTERISTICS IN THE METEOR ZONE BY THE RADAR METHOD
G. B. Pokrovskiy *In its* Meteoric Propagation of Radio Waves May 1972 p 105-117 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 17I

N72-26727*# Techtran Corp., Glen Burnie, Md.
CALCULATION OF THE EFFECT OF THE RADIATION PATTERN ANTENNAS IN DETERMINING THE PARAMETERS OF ATMOSPHERIC MOTIONS
G. M. Teptin *In its* Meteoric Propagation of Radio Waves May 1972 p 118-125 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 20N

N72-26387*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
RADAR AUGMENTATION DEVICE
John K. Riedel *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 65-72 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 17I

N72-26390*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GODDARD HELICAL TAPE RECORDER
Frank T. Martin and Dennis K. McCarthy *In its* 6th Aerospace Mech. Symp. Jun. 1972 p 89-93 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 14C

N72-26393*# Hughes Aircraft Co., El Segundo, Calif.
THE INTELSAT 4 ANTENNA POSITIONER
Frank A. Glassow *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 109-116 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 09A

N72-26394*# Ball Bros. Research Corp., Boulder, Colo.
ANTENNA DRIVE SYSTEM FOR THE NIMBUS SATELLITE
G. J. Wedlake and J. D. Loudon *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 117-120 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 09A

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N72-26155*# M&S Computing, Inc., Huntsville, Ala.
CHECKOUT/DEMONSTRATION APPLICATION PROGRAM FOR THE SEL 840MP MULTI-PROCESSING CONTROL SYSTEM: VERSION 1 (MPCS/1)
W. F. Anderson, J. R. Conway, and L. C. Keller 27 Mar. 1972 90 p
(Contract NAS8-27359)
(NASA-CR-123716; Rept-72-0013) Avail: NTIS HC $6.50 CSCL 09B

The characteristics of the application program were developed to verify and demonstrate the SEL 840MP Multi-Processing Control System - Version I (MPCS/1). The application program emphasizes the display support and task control capabilities. The application program is further intended to be used as an aid to familization with MPCS/1. It complements the information provided in the MPCS/1 Users Guide, Volume I and II. Author

N72-26156*# Massachusetts Inst. of Tech., Cambridge.
STUDY TO DEVELOP TECHNIQUES FOR A SELF-ORGANIZING COMPUTER Quarterly Progress Report, 1 Jan. - 31 Mar. 1972
Mario R. Schaffner 31 Mar. 1972 67 p refs
(Contract NASw-2276)
(NASA-CR-127114; QPR-3) Avail: NTIS HC $5.50 CSCL 09B

The main emphasis has been on the programming language for a self-organizing computer. An example of programming with the language of finite state machines is presented in a real time processing for weather radars. G.G.

N72-26157*# Teledyne Brown Engineering, Huntsville, Ala.
TRANSLATION OF SHUTTLE OPERATIONS SIMULATION FROM GPSS 2 TO GPSS 1100 Summary Report
A. J. Marshall Apr. 1972 126 p
(Contract NAS8-21804)
(NASA-CR-123637; ASD-ASTN-1512) Avail: NTIS HC $8.50 CSCL 09B

A method has been developed which enables a programmer to convert the General Purpose Systems Simulator (GPSS) 2 simulation language into the GPSS 1100 language. To accomplish the conversion, a translator deck is used in addition to hand changes made by the analyst after translation. The conversion of a particular GPSS 2 program used at the Marshall Space Flight Center (MSFC) is reported and major changes required for compatibility of the two languages are summerized. Validation of the GPSS 1100 model was completed by comparing the results of the GPSS 2 statistics to the converted 1100 model. Author

N72-26158*# Scientific Translation Service, Santa Barbara, Calif.

REALIZATION OF ADAPTIVE CONTROL ALGORITHMS WITH THE AID OF ONBOARD DIGITAL COMPUTERS

K. B. Alekseev, Ye. D. Teryaev, and I. S. Ukolov Washington NASA Jun. 1972 20 p refs Transl. into ENGLISH from Inform. Mater. Adaptivnyye Sistemy (USSR), v. 44, no. 7, 1970 p 7-19
(Contract NASw-2035)
(NASA-TT-F-14314) Avail: NTIS HC $3.00 CSCL 09B

A discussion is presented on the practical factors which must be considered during synthesis of adaptive control algorithms ensuing optimal values of a specific control system. The study is limited to flight vehicle control systems with onboard digital computers. The choice of a most suitable type of digital computer is shown to depend on the complexity of required algorithms, process rates, necessary degree of accuracy, weight and geometry restrictions, and adaptability to other computational capabilities. Energy source limitations in prolonged spacecraft flights demand the use of extensive control procedures that select control impulses required for spacecraft rotation about the equivalent Euler axis during orientational corrections. The synthesis of such a system is demonstrated. Author

N72-26159# National Research Council of Canada, Ottawa (Ontario).

ADSYM: A FORTRAN MODEL OF AN AUTOMOBILE DEFOG/DEFROST SYSTEM

E. R. Welbourne Apr. 1972 59 p refs
(NRC-NAE-LR-558) Avail: NTIS HC $5.00

Basis and use of the FORTRAN 4 program ADSYM (automobile defog/defrost system model) are described. The scope and limitations of the model and the use of the program are illustrated by examples. Possibilities for future development are briefly discussed. A complete listing of the program is given in an appendix. Author

N72-26160# Nagoya Univ. (Japan). Inst. of Plasma Physics.

CONSTRUCTION OF A DATA ACQUISITION SYSTEM

Atsushi Ogata, Kiyokata Matsuura, and Ken-ichi Hasegawa Feb. 1972 40 p refs
(IPPJ-T-7) Avail: NTIS HC $4.00

A data acquisition system is developed that will replace the present method of photographing scope traces. It digitizes analog signals directly and memorized them achieving an accuracy of 1/256, a maximum sampling rate of 1 MHz and capacity of 10 kilowords. Author

N72-26161# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).

TELEMETRY DATA PROCESSING FOR THE SATELLITE AZUR

F. W. Bertram, K. Jaekel, and K. Vitzthum Feb. 1972 103 p refs in GERMAN; ENGLISH summary
(BMBW-FB-W-72-04) Avail: NTIS HC $7.25; ZLDI Munich: 21.65 DM

The process by which the telemetry data of the satellite AZUR are transformed from analog tape records of the ground stations to digital tape records for the experimenters is described. The functions of, and the relations between the different parts of the process are summarized. The computing time and personnel hours are put into relation with the data throughput. Conclusions are drawn on the data processing for future space projects. Author

N72-26162# Joint Publications Research Service, Arlington, Va.

COMPUTER RELIABILITY ANALYSIS AND MICROCOMMAND CODING

12 Jun. 1972 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 15, no. 3, 1972 p 64-69
(JPRS-56234) Avail: NTIS HC $3.00

Algorithmic procedures are presented for simulation time reduction in computer reliability analysis and for minimum coding of microcommands for microprograms in permanent storage. For individual titles, see N72-26163 through N72-26164.

N72-26163# Joint Publications Research Service, Arlington, Va.

COMPUTER RELIABILITY ANALYSIS AND MICROCOMMAND CODING

I. I. Ladygin *In its* Computer Reliability Analysis and Microcommand Coding 12 Jun. 1972 p 1-3 ref (See N72-26162 17-08)
Avail: NTIS HC $3.00

An algorithm is presented for finding the reference points of the dependence of the reliability index on the parameters of requirements for improving system reliability. Application of the algorithm is illustrated by means of an example involving the simulation of reliability for a duplicated digital computer. It is shown that the use of the given algorithm makes it possible to shorten simulation time to less than half, compared with the algorithm employing the nondirectional sorting method. Author

N72-26164# Joint Publications Research Service, Arlington, Va.

METHOD OF MINIMUM CODING OF MICROCOMMANDS WITH MICROPROGRAMS PLACED IN PERMANENT STORAGE

M. Ye. Ipatov *In its* Computer Reliability Analysis and Microcommand Coding 12 Jun. 1972 p 4-8 refs (See N72-26162 17-08)
Avail: NTIS HC $3.00

The problem of distribution of micro-operations among the fields of the control word is solved from the standpoint of their incompatibility. To obtain codes of minimum length, each micro-operation is represented by only one field. The problem of determining the minimum coverage of a set of computer micro-operations by a set of groups of incompatible micro-operations is formulated in terms of set theory. Author

N72-26165# Joint Publications Research Service, Arlington, Va.

MONITORING THE OPERATION OF COMPLEX DATA CONTROL SYSTEMS WITH HIERARCHIC STRUCTURE

Ye. I. Orlov 12 Jan. 1972 8 p refs Transl. into ENGLISH from Izv. Vyssh. Zaved., Priborostr. (Leningrad), v. 15, no. 3, Mar. 1972 p 59-64
(JPRS-56233) Avail: NTIS HC $3.00

The problem of selecting the optimum period for monitoring the condition of complex data control systems is discussed. A simulating algorithm of step-by-step optimization is described for determining the maximum possible time of monitoring automatic control systems. Author

N72-26166# Joint Publications Research Service, Arlington, Va.

FORECAST ON FUTURE USES OF COMPUTERS TECHNOLOGY

Yz. Fedorovskiy, comp. and V. Siforov 13 Jun. 1972 10 p Transl. into ENGLISH from Literaturnaya Gazeta (Moscow), no. 11, 15 Mar. 1972 p 11
(JPRS-56250) Avail: NTIS HC $3.00

Future uses of electronic computer technology in automatic libraries, teaching machines, self-adjusting robots, and in direct interactions between the human brain and the computer in a symbiosis are outlined. G.G.

N72-26167# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.

A GENERAL PURPOSE ALGORITHM FOR CONTOURING

OVER SCATTERED DATA POINTS
K. J. Falconer Sep. 1971 48 p refs
(NPL-NAC-6) Avail: NTIS HC $4.50

The theory and operation of an algorithm for automatic contouring suitable for use with irregular distributions of data points are described. The algorithm is designed for general data. Initially a surface is fitted to the data points by using a least squares method on a weighted low degree polynomial function, and contours are drawn to this surface using a step by step method. A rectangular mesh is superimposed onto the map area to facilitate the detection of contours, but contours are drawn to the original data points as opposed to calculated heights at secondary points. The algorithm is presented as an ALGOL procedure and produces reasonable maps without requiring an excessive amount of computer time. Author (ESRO)

N72-26168# Naval Postgraduate School, Monterey, Calif.
AN ANALYSIS OF MAN-MACHINE COMMUNICATION IN AN INTERACTIVE GRAPHICAL ENVIRONMENT M.S. Thesis
Robert Wayne Cassell, Jr. Dec. 1971 61 p refs
(AD-738905) Avail: NTIS CSCL 09/2

The failure of present-day interactive graphical systems to provide for an effective relationship between man and machine is examined. An inefficient communications link is shown to be the basis of the problem. The manner in which the user controls program flow and the hardware utilized in inputting commands are revealed as the basic components of communication. Program control is investigated. A revised control method is described which consists of a series of function executions and six basic phases of activity for program control. With respect to input hardware, more human factors analysis is advocated. To assist in this analysis, a function classification system is described. An example test is conducted to compare the relative merits of the light pen with menu, the teletype, and function switches. Author (GRA)

N72-26169# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
A COMPREHENSIVE SIMULATION FOR THE GUIDANCE PERFORMANCE ANALYSIS OF ADVANCED AIR DEFENSE SYSTEMS
Charles L. Lewis 1 Nov. 1971 193 p
(DA Proj. 1X2-63302-D-212)
(AD-738527; RG-TR-71-18) Avail: NTIS CSCL 15/3

The report contains a general description of the Guidance and Control Directorate's all-digital air defense guidance performance simulation. An overall functional view of the simulation is given, which describes the basic intercouplings data transfer requirements, sequencing, etc. A brief description of each subroutine is enclosed, as is a more indepth discussion of the program's input-output format. A Fortran IV listing of the program is included. Author (GRA)

N72-26924* Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.
PERFORM: A COMPUTER PROGRAM TO DETERMINE THE LIMITING PERFORMANCE OF PHYSICAL SYSTEMS SUBJECT TO TRANSIENT INPUTS
Walter D. Pilkey and Bo Ping Wang *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 185-190 refs (See N72-26904 17-32)
(Grant NGR-47-005-145)
(NASA-CR-127001) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 09B

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N72-26170*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FLAT CONDUCTOR CABLE FOR ELECTRICAL PACKAGING
Wilhelm Angele 21 Jan. 1972 17 p refs
(NASA-TM-X-64667) Avail: NTIS HC $3.00 CSCL 09A

Flat conductor cable (FCC) is relatively new, highly promising means for electrical packaging and system integration. FCC offers numerous desirable traits (weight, volume and cost savings, flexibility, high reliability, predictable and repeatable electrical characteristics) which make it extremely attractive as a packaging medium. FCC, today, finds wide application in everything from integration of lunar equipment to the packaging of electronics in nuclear submarines. Described are cable construction and means of termination, applicable specifications and standards, and total FCC systems. A list of additional sources of data is also included for more intensive study. Author

N72-26171*# Watkins-Johnson Co., Palo Alto, Calif.
DEVELOPMENT OF AN X-BAND 25 WATT TRAVELING-WAVE TUBE Final Report
L. A. Roberts and R. I. Knight 17 Mar. 1972 60 p refs
Prepared for JPL
(Contracts NAS7-100; JPL-952931)
(NASA-CR-127068) Avail: NTIS HC $5.00 CSCL 09E

The development of a 25 watt high efficiency travelingwave tube at 8.5 GHz for space communications and telemetry applications is reported. Described is the design basis for the tube, which is known as the WJ-3703. Because of the combinec high efficiency and high frequency requirements, the helix and body dimensions are very small and require special techniques for various assembly and construction procedures. These are described in detail. Measurement results of focusing tests and RF operation are given, but only pulsed RF performance of the tubes was obtained. Author

N72-26172# Technischen Universitaet, Munich (West Germany).
INVESTIGATION OF MODULATION NOISE IN GUNN OSCILLATORS
P. Kuhn Apr. 1972 99 p refs In GERMAN; ENGLISH summary
(BMBW-FB-W-72-06) Avail: NTIS HC $7.00; ZLDI Munich: 20,60 DM

The importance of the modulation noise in Gunn oscillators is demonstrated experimentally. The power spectra of the respective low frequency noise mechanisms are derived and analyzed with regard to the absolute power level, frequency and temperature dependence. In this procedure the subdivision of the Gunn element in locally different areas turns out to be necessary. From these results and the measurements of the spectrum and its temperature dependence the noise mechanism being effective in the Gunn element is identified. Corresponding experiments are carried out for the surface of the semiconductor taking into account the influence of the area of the cathode contact. Author

N72-26173# Oklahoma Univ. Research Inst., Norman.
AN INVESTIGATION OF RELIABLE, HIGH CURRENT FLUX PUMPS Final Report, Oct. 1968 - Jun. 1971
Keith J. Carroll Jul. 1971 47 p refs
(Contract DAAK02-69-C-0082; DA Proj. 1T6-62705-A-012)
(AD-738575; OURI-1680-2) Avail: NTIS CSCL 09/1

Superconducting flux pumps are constructed and tested. The device consist of a small superconducting coil in parallel

with a larger magnet, attached to the secondary of a transformer and immersed in a liquid helium bath. The rate of pumping is related to the power supply signal and the intensity of the magnetic biasing field applied to the switching coil. An expression relating magnet current to circuit component parameters after n pumping cycles is developed and shown to qualitatively agree with experimental observations.
Author (GRA)

N72-26174# Army Electronics Command, Fort Monmouth, N.J.

ANALYSIS OF THERMAL RESISTANCE AND HEAT REMOVAL IN MESA AND ETCH-AND-REFILL PLANAR IMPATT DIODES

Herbert L. Mette Dec. 1971 17 p refs
(DA Proj. 1S6-62705-A-440)
(AD-738582; ECOM-3519) Avail: NTIS CSCL 09/1

The thermal resistance of planar IMPATT diodes was compared to that of mesa structures, and its dependence on diode diameter and thickness of the substrate calculated. The analysis shows that planar diodes always possess lower thermal resistances than mesa diodes, provided the distance from the junction to the heat sink is identical in both cases. The advantage of planar diodes for very short junction distances of 1/10 that of the junction radius, however, is minute. By increasing junction distances from the heat sink, the advantage of planar configurations becomes more pronounced; ultimately, planar diodes are expected to show higher power densities and efficiencies than mesa structures. Author (GRA)

N72-26175# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

COMPLETE THEORY OF ACOUSTIC BULK WAVE PROPAGATION IN ANISOTROPIC PIEZOELECTRIC MEDIA

A. J. Slobodnik, Jr. and J. V. OBrien 24 Nov. 1971 90 p refs
(AF Proj. 5635)
(AD-739162; AFCRL-71-0601; AFCRL-PSRP-468) Avail: NTIS CSCL 09/1

A complete analysis of acoustic bulk wave propagation in arbitrary, anisotropic, piezoelectric media is presented. All mechanical and electrical quantities of interest are calculated. Propagation loss can be computed using the viscosity tensor approach. The entire analysis is implemented by a computer program which is described in detail. A complete listing and sample input-output data are provided. Thus all necessary information for the quantitative design of high-frequency, low-insertion-loss, long-time-delay, microwave-acoustic-bulk-wave delay lines and other signal processing devices is provided.
Author (GRA)

N72-26176# American Micro-Systems, Inc., Santa Clara, Calif.

MICROPOWER INTEGRATED CIRCUITS STUDY PROGRAM Final Report

Jay L. Farley, Bruce O. Jordan, Daryl E. Mullins, and Perris Pringle Oct. 1971 102 p
(Contract DAAA21-69-C-0559)
(AD-738538) Avail: NTIS CSCL 09/5

The Extension to Scope of Work provides further study of items not investigated completely by the original basic contract. These are the items dealing with computerized models of the field effect transistor. The primary computer model is the SCEPTRE program. Author (GRA)

N72-26177# Harry Diamond Labs., Washington, D.C.

THE RF CHARACTERISTICS OF A CYLINDRICAL LOOP ANTENNA

Walter A. Riessler Dec. 1971 34 p refs
(DA Proj. 1W2-62301-A-207)
(AD-738560; HDL-TR-1576) Avail: NTIS CSCL 09/5

The inductance, radiation resistance, and surface current distribution of a perfectly conducting cylindrical loop are determined from first principles for the case of uniformly distributed driving voltage. First and second order terms derived in analytic form predict values which agree well, within limits imposed by the approximations made, with values calculated by computer for the general case. Briefly, to terms of second order, loop radiation resistance is independent of conductor width and increases with frequency in the same manner as a wire loop. Effective loop inductance increases with frequency, the rate increasing with the ratio of loop width to diameter. The current density is greatest near the edges of the conductor and the relative concentration on the inner surface increases with loop width. Author (GRA)

N72-26178# Naval Postgraduate School, Monterey, Calif.

COEFFICIENTS OF COUPLING FOR COUPLED-CAVITY SLOW WAVE STRUCTURES M.S. Thesis

Randall Eugene Offutt Jun. 1971 39 p refs
(AD-738895) Avail: NTIS CSCL 09/5

A method is presented for evaluating the coupling coefficients associated with loosely coupled cavity structures. The measure of coupling is expressed in terms of the shift in resonant frequency exhibited by a single aperture-coupled cavity. The frequency shift is determined from the resonant frequency of an equivalent circuit representing the aperture-coupled cavity. This method of analysis is applied to a specific waveguide cavity, coupled by a small circular aperture. The results of this method are then presented for comparison with those obtained by two other techniques. Author (GRA)

N72-26179# Collins Radio Co., Cedar Rapids, Iowa.

HIGH STABILITY TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR STUDY (HSTCXO) Semiannual Interim Report, 1 Mar. - 31 Aug. 1971

Gayle E. Buroker Jan. 1972 47 p refs
(Contract DAAB07-71-C-0136; DA Proj. 1H6-62705-A-05802)
(AD-738837; ECOM-0136-1) Avail: NTIS CSCL 09/5

The objective of this study is the development of a high-stability temperature-compensated crystal oscillator (HSTCXO), capable of being produced in quantity for use in advanced SSB communications equipment. Primary characteristics of the HSTCXO are small size, low power, minimal warm-up time, and frequency-temperature stability of plus or minus 5pp 10 to the 8th power from -40 to 80 C. A well-delineated compensation procedure is to be included in the development, and three exploratory HSTCXO's are to be fabricated to validate the procedure. Author (GRA)

N72-26180# Stanford Univ., Calif. Microwave Lab.

ACOUSTIC SURFACE WAVE RESEARCH Semiannual Report, 1 Mar. - 31 Aug. 1971

M. Chodorow, H. J. Shaw, G. S. Kino, T. M. Reeder, and L. A. Coldren Dec. 1971 64 p refs
(Contract DAAB07-71-C-0145)
(AD-738836; ML-2000; ECOM-0145-1) Avail: NTIS CSCL 09/1

New results are reported for wrap-around type delay lines, involving time delays of 2 milliseconds for passive lines without internal amplification, time delays of 20 milliseconds with internal surface wave amplifiers on large bismuth germanium oxide crystals, and demonstration of control of the threshold for noise buildup in such systems which is expected to lead to increased time delays in future devices. Internal experiments on a balanced-phase two-port configuration for wrap-around lines, designed to avoid bidirectional transducer losses, show the correct fringe pattern versus frequency. Results on electronically-tunable digital cross-correlation in a parametric surface acoustic wave device are presented which show improved conversion efficiency, reduced spurious levels, and good comparison of experiment and theory for Barker bi-phase codes up to 5 bits, and discrepancies in side lobe levels for larger number of bits, which are being investigated. Author (GRA)

N72-26181# Raytheon Co., Waltham, Mass. Research Div.

UHF FERRITES GARNETS Semiannual Technical Report, 1 May - 31 Dec. 1971

H. J. VanHook and J. J. Green Jan. 1972 78 p refs
(Contract DAAB07-71-C-0174; DA Proj. 1T0-62105-A-348)
(AD-738834; S-1391; ECOM-0174-1) Avail: NTIS CSCL 09/5

Two objectives have been defined for the performance of this contract. The first is the development of a low loss temperature stable magnetic garnet for an above resonance microwave UHF circulator. The second is to develop an S-band phase shifter material which would offer some improvement in temperature stability and lower materials cost over presently available ferrites. Dense, single phase garnet has been produced with the composition Y 1(.70)Ca(1.30)In(.35)V(.65)Fe(4.00)O(12). A survey has been made of the garnet and spinel S-band phase-shifter materials. A processing study has been started on a calcium-vanadium substituted YIG. Compositions with and without manganese substitutions have been prepared to explore the effect on remanent magnetization and stress sensitivity. Author (GRA)

N72-26182# Army Electronics Command, Fort Monmouth, N.J.

FUNDAMENTAL AND HIGHER ORDER MODE ANALYSIS OF THE HELIX AND HELIX RELATED CIRCUITS

Louis J. Jasper, Jr. Jan. 1972 45 p refs
(DA Proj. 1S6-62705-A-055)
(AD-738831; ECOM-3530) Avail: NTIS CSCL 09/1

An analysis of the fundamental and higher-order modes is presented for various geometrical configurations of circuits used in traveling-wave tubes. The field theory approach is used in treating the problem, and the results are given in the form of equations and graphs. General solutions are obtained that apply to an assortment of circuit geometries, and specific boundary conditions are applied to the general solutions to yield the results for a particular circuit. The electromagnetic field equations and coefficients, dispersion equations, and interaction impedances are presented. A compilation of graphs is given to show the characteristics of the various modes for the circuits studied. Author (GRA)

N72-26183# Army Missile Command, Redstone Arsenal, Ala. Advanced Research Projects Agency Support Office.

FIELD EFFECT ELECTRON EMISSION

Joe Shelton 30 Aug. 1971 14 p refs
(ARPA Order 1637)
(AD-738529; RN-TR-71-1) Avail: NTIS CSCL 09/1

The emission of electrons from materials at ambient temperature due to the field effect is a subject of extensive study and experimentation. Although large current densities, greater than 100 A/sq cm, have been realized from sharp points, few commercial applications have resulted because of the problems associated with fabricating multiple point sources. Recent developments in fabrication procedures have resulted in multiple point sources of sufficient size and uniformity to be applicable to electronic devices such as electron tubes which require a copious supply of electrons for operation. Current densities of near 100 mA/sq cm have been realized from early samples indicating that these new multiple point sources emit electrons in sufficient numbers to replace thermionic emitters in several classes of electron tubes. Author (GRA)

N72-26747*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ANALYSIS OF SURVEYOR 3 TELEVISION CABLE

F.C. Gross and J. J. Park *In its* Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 119-125 (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 09A

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N72-26184 National Lending Library for Science and Technology, Boston Spa (England).

EFFECT OF INTERNAL IMPEDANCE OF VOLTAGE SOURCE ON BREAKDOWN OF AIRGAPS

K. Feser 30 Mar. 1972 15 p refs Transl. into ENGLISH from Elektrotech. Z. (Berlin), v. 92, no. 8, 1971 p 495-500
(NLL-CE-Trans-5688-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

With all types of voltages the internal impedance affects the breakdown of air gaps in a non-uniform field. If the type of voltage is not modified by predischarges when the capacitance of the testpiece, together with any capacitances of the voltage divider which may be present amounts to about 300 to 500 pF, the predischarge behavior is affected by the internal impedance of the voltage source in a certain gap range, the transition zone. With the non-rigid voltage source the formation of predischarges is modified by a given arrangement. Author

N72-26185 University of Southern Calif., Los Angeles.

THEORY OF CASCADED AND PARALLEL TRACKING SYSTEMS WITH APPLICATIONS Ph.D. Thesis

Joseph Hsui-Lau Yuen 1971 158 p
Avail: Univ. Microfilms Order No. 71-27967

Two basic configurations of inter-connected phase locked nonlinear oscillators are examined namely, those connected in series and those in parallel. The theory developed is applicable to analyzing system performance and designing a class of coherent communications and tracking systems. It is shown how to apply the theory to the following system mechanizations: (1) carrier tracking, (2) Doppler tracking, (3) suppressed carrier tracking, (4) data-aided carrier tracking, (5) tracking and data relay transponder, and (6) polarization tracking. Dissert. Abstr.

N72-26186*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.

AN ALGORITHM FOR CONTROL SYSTEM DESIGN VIA PARAMETER OPTIMIZATION M.S. Thesis

Prasun K. Sinha Jan. 1972 95 p refs
(Grant NGL-22-009-548)
(NASA-CR-116778; TE-49) Avail: NTIS HC $6.75 CSCL 09B

An algorithm for design via parameter optimization has been developed for linear-time-invariant control systems based on the model reference adaptive control concept. A cost functional is defined to evaluate the system response relative to nominal, which involves in general the error between the system and nominal response, its derivatives and the control signals. A program for the practical implementation of this algorithm has been developed, with the computational scheme for the evaluation of the performance index based on Lyapunov's theorem for stability of linear invariant systems. Author

N72-26187*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TOROIDAL TRANSFORMER DESIGN PROGRAM WITH APPLICATION TO INVERTER CIRCUITRY

James A. Dayton, Jr. Washington Jun. 1972 38 p refs
(NASA-TM-X-2540; E-6785) Avail: NTIS HC $3.00 CSCL 09E

Estimates of temperature, weight, efficiency, regulation, and final dimensions are included in the output of the computer program for the design of transformers for use in the basic parallel inverter. The program, written in FORTRAN 4, selects a tape wound toroidal magnetic core and, taking temperature, materials, core geometry, skin depth, and ohmic losses into account, chooses the appropriate wire sizes and number of turns for the center tapped primary and single secondary coils. Using the program, 2- and 4-kilovolt-ampere transformers are designed for frequencies from 200 to 3200 Hz and the efficiency of a basic transistor inverter is estimated. Author

N72-26188# Joint Publications Research Service, Arlington, Va.
CALCULATION OF CAPACITANCE OF SPHERICAL ELECTRODE ROTOR
A. N. Balyasnikova and A. M. Korovkin 12 Jun. 1972 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Priborostr. (Leningrad), v. 15, no. 3, 1972
(JPRS-56238) Avail: NTIS HC $3.00

Mathematics for calculating the capacitance of a spherical electrode rotor with arbitrary displacement of the rotor is discussed. Graphs are presented to show dependences of capacitance on the relative displacement of the rotor for electrodes in the form of a spherical ring and segment. Author

N72-26189# Rochester Univ., N.Y. Nuclear Structure Research Lab.
A TRIGGERED SPARK GAP WITH ROTATING ELECTRODES
H. W. Fullbright May 1972 6 p Sponsored by NSF
(UR-NSRL-53) Avail: NTIS HC $3.00

A spark gap used for triggering a spark counter is described, featuring rotating electrodes. It operates for more than 10 to the 8th power firings without apparent deterioration of characteristics. Author

N72-26190# Northeastern Univ., Boston, Mass. Dept. of Physics.
REPRESENTATION OF A THEORY OF CURRENTS
Robert Perrin Jun. 1972 17 p refs Sponsored by NSF
(NUB-2138) Avail: NTIS HC $3.00

A canonical representation is given for a recently proposed theory of currents. The solutions differ from the analogous representation of Sugawara's theory in that one less constraint is present. This allows one to break the additional O(4) symmetry which would otherwise be present. The difficulties in obtaining perturbative solutions are the same in both theories. Author

N72-26191# Grumman Aerospace Corp., Bethpage, N.Y.
OPTIMALITY OF LINEAR CONTROL SYSTEMS
E. Kreindler and A. Jameson Mar. 1972 19 p refs Submitted for publication
(RM-537J) Avail: NTIS HC $3.00

It is shown that every linear system with nondynamic feedback is optimal with respect to a quadratic performance index that includes a cross-product term between the state and control. If the index is further generalized to include derivatives of the control, every (sufficiently smooth) linear, finite-dimensional dynamic feedback and feedforward control system is optimal with respect to such an index. Methods of constructing all such indices are indicated, and some practical implications are discussed. Author

N72-26192# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
WR15 THERMAL NOISE STANDARD
W. C. Daywitt, W. J. Foote, and E. Campbell Mar. 1972 155 p refs
(NBS-TN-615) Avail: SOD $1.25 as C 13.46:615

The design and construction of a thermal noise power standard is described. The standard is designed to operate around the silver point temperature (963.19 deg C) with a noise temperature output accurate to approximately plus or minus 2 K. Complete details of the theory, design, construction, and performance tests are given. Author

N72-26193# Joint Publications Research Service, Arlington, Va.
MATERIALS ON FIFTH ALL-UNION CONTROLS CONFERENCE
13 Jun. 1972 59 p refs Transl. into ENGLISH from Avtomat. i Telemekh. (Moscow), no. 2, 1972 p 5-16 and 180-199 Conf. held at Moscow, 4-8 Oct. 1971
(JPRS-56251) Avail: NTIS HC $5.00

Summaries of papers presented at conference on control problems, and an article on the behavior of man in control systems are presented. For individual titles, see N72-26194 through N72-26196.

N72-26194# Joint Publications Research Service, Arlington, Va.
MAN IN CONTROL SYSTEM c05
V. A. Trapeznikov *In its* Mater. on Fifth All-Union Controls Conf. 13 Jun. 1972 p 1-17 refs (See N72-26193 17-10)
Avail: NTIS HC $5.00

Man's behavior in technical, and socioeconomic control systems is discussed in terms of three types of problems: (1) how to organize the control structure with a correct distribution of functions between man and the automatic machine; (2) how to organize the relationship between man and the automatic machine; and (3) how to make man strive. Feedback and game situations are considered for social and economic control systems. It is concluded that man is the main resource, and the mobilization of all his psychological reserves, along with the use of control hardware will greatly speed up scientific and technical progress and the nation's development. F.O.S.

N72-26195# Joint Publications Research Service, Arlington, Va.
FIFTH ALL-UNION CONFERENCE ON CONTROL PROBLEMS
O. A. Kossov and A. I. Propoy *In its* Mater. on Fifth All-Union Controls Conf. 13 Jun. 1972 p 18-50 refs (See N72-26193 17-10)
Avail: NTIS HC $5.00

The papers presented to the conference on control problems are summarized. Topics discussed include: (1) control problems in the national economy, (2) control of economic systems, (3) operations research, (4) large systems, (5) automated control system, (6) optimization and optimal control, and (7) robot development. F.O.S.

N72-26196# Joint Publications Research Service, Arlington, Va.
DECISION OF FIFTH ALL-UNION CONFERENCE ON CONTROL PROBLEMS
In its Mater. on Fifth All-Union Controls Conf. 13 Jun. 1972 p 51-56 (See N72-26193 17-10)
Avail: NTIS HC $5.00

The research tasks recommended for national economic development by the conference on control problems are reported. The areas in which research should be conducted include: theory and methods for optimal control, new methods for synthesis of continuous and discrete control devices, theory of large systems, theoretical and applied research on long-range problems, standardized devices for the state system of instruments, and control of complex production and economic systems. F.O.S.

N72-26197# Joint Publications Research Service, Arlington, Va.
CONTROLLABILITY OF LINEAR STABLE SYSTEMS
R. Gabasov, F. M. Kirillova, and V. V. Krakhotko 6 Jun. 1972 5 p Transl. into ENGLISH from Dokl. Akad Nauk SSSR (Moscow), v. 203, no. 3, 1972
(JPRS-56182) Avail: NTIS HC $3.00

A rigorous exposition of a control system is presented and criteria for controllability of a system expressed through its parameters are developed Author

N72-26198# Technische Universitaet, Brunswick (West Germany). Inst. fuer Hochspannungstechnik.
INVESTIGATIONS ON HIGH VOLTAGE PULSERS AND

AMPLIFIERS FOR THE EXACT TIMING OF THE IGNITION OF SPARK DISCHARGERS
Manfred Pillsticker Dec. 1971 37 p refs In GERMAN; ENGLISH summary
(BMBW-FBK-71-22) Avail: AEC Depository Libraries

Fundamental investigations on high-voltage pulsers and amplifiers required for low jitter switching of several plasma physical experiments by triggered spark gaps are reported. The theoretical relations stated show whether the individual components of these tools are suitable. Novel cable amplifiers for pulses, switching problems, low inductance triggered spark gaps, and the circuit diagrams used are explained. The tools developed and tested are described and methods of generating and amplifying high voltage pulses are given. Author (NSA)

N72-26199# Technische Hogeschool, Eindhoven (Netherlands).
METHODS AND ASPECTS OF ACTIVE-RC FILTER SYNTHESIS M.S. Thesis
W. M. G. vanBokhoven 10 Dec. 1970 75 p refs
(TH-71-E-27) Avail: NTIS HC $5.75

Lumped RC active filter realizations and synthesis methods are described and compared based on sensitivity and stability. Three possibilities to simulate the inductance are reviewed: by replacing inductors, by gyrators terminated with capacitors, by coupling gyrators and RC networks, and by splitting the filter transfer function in first and second order parts, each of which may be realized by a suitable active network with RC elements. Author (ESRO)

N72-26200# Naval Postgraduate School, Monterey, Calif.
LOW POWER DIGITAL INTEGRATED CIRCUIT DESIGN FOR AN UNUSUAL EVENT DETECTOR M.S. Thesis
Robert Ervin Bruninga Jun. 1971 105 p refs
(AD-738970) Avail: NTIS CSCL 08/10

A deep ocean capsule is proposed capable of sensing pressure, temperature, flow and direction for a study of tides and internal waves of the oceans. One of the major requirements for this capsule is the detection and recording of unusual events. To meet this need a very low power, highly reliable digital detector has been designed. COS/MOS logic with maximum use of MSI and LSI was used in the design. The detector was simulated using proposed word lengths and fixed point arithmetic which would be utilized in the ensuing hardware. The fixed point simulation was necessary to verify the problems in truncation and round-off errors and to provide necessary design criteria to ensure proper filter functioning and integral detection. Author (GRA)

N72-26201# Naval Postgraduate School, Monterey, Calif.
PARAMETER PLANE STUDY OF THE OPTIMAL REGULATOR M.S. Thesis
Lionel Alfonso Doren Swett Jun. 1971 71 p refs
(AD-738888) Avail: NTIS CSCL 12/1

Parameter plane studies of an optimal second order regulator are presented. Emphasis is placed on the interpretation of the cost function and the sensitivity of the cost function to plant parameter incremental variations. An analysis is made of cost functions weighting factors and their effect on damping, speed of response, and cost. Author (GRA)

N72-26202# Naval Postgraduate School, Monterey, Calif.
AN ANALYSIS OF FREQUENCY DISTORTION IN DIGITAL FILTER DESIGN M.S. Thesis
James Willoughby Howard Jun. 1971 73 p refs
(AD-738897) Avail: NTIS CSCL 09/5

The theory and background of the algebraic substitution synthesis method for digital filters from continuous filter characterizations is presented with emphasis on the frequency distortion phenomenon. An analysis of the Forward Euler, Backward Euler and Trapezoidal numerical integration algorithms is undertaken and appropriate transformations are obtained. A general integration formula, encompassing the above algorithms as special cases, is analyzed and its application to the synthesis problem is pointed out. Direct transformations for discrete filter frequency response characteristics from continuous filter characterizations are derived. Author (GRA)

N72-26203# Naval Postgraduate School, Monterey, Calif.
HIGH G TESTING OF ELECTRONIC COMPONENTS M. S. Thesis
Samuel Allen Miles, II Jun. 1971 75 p refs
(AD-738907) Avail: NTIS CSCL 09/3

High-g acceleration produced by large bore guns is compared with impact acceleration. Methods for subjecting electronic components and circuit packages to high-g launch environments up to 550,000-g are outlined and analyzed. An analysis of the effect of the high-g environment on components is performed on a component by component basis. Methods for selecting, 'hardening' and testing components for high-g circuitry are given as are circuit construction and assembly details. An extensive appendix listing type, manufacturer and part number is included for components that have survived high-g environmental testing. Recommendations are made for an improved test program that will yield a new generation of reliable high-g hardened components for circuit design. Author (GRA)

N72-26204# Naval Postgraduate School, Monterey, Calif.
SIMULATION AND CONTROL OF DISTRIBUTED PARAMETER SYSTEMS M.S. Thesis
Antonio Luis DeCarvalhoMoitinhoDeAlemeida Dec. 1971 172 p refs
(AD-738872) Avail: NTIS CSCL 12/1

The present work is an attempt to put together the most relevant aspects of the engineering problems involving distributed parameter systems. Simulation and optimal control are explained in detail. The original contribution of this thesis is given in Chapters 5 and 6, where modal control theory and a gradient subroutine that searches for the optimal reference coefficients are used. As a result, it was possible to obtain an output distribution better than the one achievable by the known methods. This technique works in situations of strongly nonlinear control and compensates the effect of having the analyzer and synthesizer approximated by low order matrices. It also makes it possible to give higher weight to some zones of the output distribution in order to have a better local fit. Author (GRA)

N72-26205# Ohio Univ., Athens. Dept. of Electrical Engineering.
SUBOPTIMAL CONTROLLER DESIGN FOR BOUNDED STATE SYSTEMS
Russell M. Hayes Feb. 1972 150 p refs
(Contract DAAB07-68-C-0084)
(AD-738835; EER-16-12; ECOM-0084-F1) Avail: NTIS CSCL 12/1

Design of a controller for a given system usually requires consideration of more than satisfaction of dynamical and steady-state performance requirements. Factors such as cost, reliability, simplicity of design, and limitations on system outputs and control magnitudes must be considered. Often the controller must be designed in such a way as to meet certain constraints on system performance when noise is present. The goal of this research is to provide a controller which will yield satisfactory dynamical and steady-state performance, as measured by an integral index of performance, and will ensure non-violation of a set of output inequality constraints. These requirements must be met even if noise is present in the system. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N72-26206# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
DESIGN AND INSTALLATION OF A WIND TUNNEL FAN
T. A. P. S. AppaRao Dec. 1971 28 p refs
(UTIAS-TN-170) Avail: NTIS HC $3.50

The design and installation of a fan in a low speed wind tunnel are discussed. The objective of the design was to obtain a maximum test section wind velocity of approximately 220 feet per second while operating the fan at angles of attack well below the stall limit. The restrictions imposed on the fan operation are discussed. Details of the manufacture of blades, balancing of the fan, and its installation are given. The predicted and achieved performance of the fan are compared and reasons for discrepancy are suggested. Author

N72-26207*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK, VOLUME 9 Progress Report, Mar. - Apr. 1972
15 Jun. 1972 239 p refs
(Contract NAS7-100)
(NASA-CR-127048; JPL-TR-32-1526-Vol-9) Avail: NTIS HC $14.00 CSCL 09F

Progress on DSN supporting research and technology is reported. Topics discussed include: descriptions of the objectives, functions, organization, facilities, and communication; Pioneer support; and advanced engineering. F.O.S.

N72-26208# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
TWO MORE WIND TUNNELS DRIVEN BY AEROFOIL-TYPE CENTRIFUGAL BLOWERS
P. Bradshaw Apr. 1972 16 p refs
(IC-Aero-72-10) Avail: NTIS HC $3.00

Design and operation of low turbulence wind tunnels driven by aerofoil-type centrifugal blowers at entries are reported. Each of the tunnels has a straight sided wide angle diffuser after the blower with two screens in order to refract the air flow into the expansion. The tunnels have been used for a wide variety of experiments and their performance has been satisfactory. G.G.

N72-26209# Joint Publications Research Service, Arlington, Va.
CONSTRUCTING A SPACE GEODETIC NETWORK BY THE LINE-ANGLE METHOD
V. I. Medvedskiy 21 Jun. 1972 8 p refs Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 1, 1972 p 20-25
(JPRS-56328) Avail: NTIS HC $3.00

The possibility of constructing a space geodetic network by the line-angle method with the use of a laser is examined. It was found that the accuracy of finding the coordinates of terrestrial points from such constructions is around 5 m. Certain associated technical questions are considered, including accurate tracking of the artificial earth satellite, determination of the laser force required for optical tracking, and the energy of the laser required for photographing the satellite-balloon. Author

N72-26210# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
THE ELECTROFLUID DYNAMIC AUGMENTED WIND TUNNEL
Frank L. Wattendorf and Elmer G. Johnson 18 Jul. 1972 9 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Nov. 1972
Avail: NTIS HC $3.00

A new technique for producing high enthalpy flows for flight simulation in wind tunnels is reported. The unique concept examined envolves the addition of enthalpy to the gas flow by electrofluid dynamic (EFD) energy conversion which increases the flow velocity at essentially constant static pressure and temperature. Author

N72-26211# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
PHYSICAL AND ECONOMIC FACTORS WHICH WILL AFFECT THE DESIGN OF THE EUROPEAN SUPERCONDUCTING SYNCHROTRON
Michael A. Green Sep. 1971 13 p refs
(KFK-EXT-3-71-9) Avail: AEC Depository Libraries

The construction of the CERN 2 Sychrotron as either totally or partly superconducting will take place only if it is economically justified. Many of the machine design parameters will be determined by the conventional synchrotron which will be built first. Within this framework, economic considerations will play a dominant role in determining the parameters of the superconducting machine. This report discusses four options which one can take for building a superconducting synchrotron at CERN. Machine parameters are discussed in terms of economics. Optimization of field, aperture, and cycle time are discussed. A list of basic machine parameters and probable component parameters is presented. Author (NSA)

N72-26212# Atomic Energy Commission, Idaho Falls, Idaho. Health Services Lab.
[HEALTH RELATED RADIATION RESEARCH] Annual Report, 1970
1971 51 p refs
(IDO-12075) Avail: NTIS

The Health Services Laboratory (HSL) is composed of five branches: Analytical Chemistry, Dosimetry, Environmental, Instrumentation, and Medical. Additionally, the U.S. Geological Survey (USGS) and the Air Resources Laboratories Field Research Office of the National Oceanic and Atmospheric Administration (NOAA) maintain technical staffs at the National Reactor Testing Station for which the HSL provides programmatic direction for their NRTS activities. The first responsibility of the Laboratory is to the NRTS, supplying services to the contractors in various fields including industrial medicine, personnel dosimetry, portable instrumentation, chemical and radiochemical analyses, as well as providing all environmental monitoring on and off the NRTS for air, water, soils, vegetation, and other selected types of samples such as milk and food grains. NSA

N72-26213# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Experimentelle Aerodynamik.
EXTENSION OF THE BRUNSWICK SUPERSONIC WIND TUNNEL FOR TRANSONIC PROFILE MEASUREMENTS [DER AUSBAU DES BRAUNSCHWEIGER UEBERSCHALL-WINDKANALS FUER TRANSSONISCHE PROFILMESSUNGEN]
Fred Thomas and Gerhard Kausche 1972 29 p refs In GERMAN; ENGLISH summary
(DLR-MITT-72-02) Avail: NTIS HC $3.50; DFVLR, Porz-Wahn: 9 DM

Arguments and technical proposals are presented for the extension of an existing supersonic wind tunnel to accomodate transonic profile measurements. It is pointed out that transonic wing aerodynamics are of special importance for the development of the next generation of airplanes and helicopters. It is shown that modification of the supersonic wind tunnel at the Institute of Aerodynamics at Braunschweig is technically and economically feasible. Author (ESRO)

N72-26214# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
FEASIBILITY OF USING MEMBRANE-ENVELOPED SOIL LAYERS AS PAVEMENT ELEMENTS FOR MULTIPLE WHEEL HEAVY GEAR LOADS Final Report, Jun. - Aug. 1970
Cecil D. Burns, William N. Brabston, and Robert W. Grau Feb. 1972 66 p refs
(AD-738839; AEWES-Misc-Paper-S-72-6) Avail: NTIS CSCL 13/2

The investigation reported herein was conducted to (a) determine the feasibility of using membrane-enveloped soil layers (MESL) as structural elements in flexible pavements and (b) investigate the performance of MESL construction under multiple-wheel heavy gear load (MWHGL) traffic. A test section was constructed within the existing MWHGL test section at the U. S. Army Engineer Waterways Experiment Station utilizing the existing 4-CBR clay subgrade. The performance of the test items under traffic showed that the concept of utilizing MESL's as structural elements in pavement construction is feasible.
Author (GRA)

N72-26215# ARO, Inc., Arnold Air Force Station, Tenn.
A THEORETICAL AND EXPERIMENTAL STUDY OF A JET STRETCHER DIFFUSER SYSTEM Final Report, 1 Jul. 1970 - 30 Jun. 1971
R. C. Bauer, E. H. Matkins, and R. L. Barebo AEDC Mar. 1972 45 p refs
(Contract F40600-72-C-0003; AF Proj. 3012; ARO Proj. RU5102)
(AD-738646; ARO-ETF-TR-71-246; AEDC-TR-72-246) Avail: NTIS CSCL 14/2

A theoretical and experimental study of the steady-state performance of a jet stretcher diffuser system is presented. The steady-state starting conditions are determined by limits imposed by the nozzle exit boundary layer, the blockage area, and the jet stretcher ambient pressure level. Analytical techniques are presented for estimating the starting boundary conditions related to either the nozzle exit boundary layer limit or the jet stretcher ambient pressure level limit. Limited experimental results for a small scale system are presented.
Author (GRA)

N72-26863*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
EQUIPMENT CONSIDERATIONS FOR ULTRA LOW FREQUENCY MODAL TESTS
R. G. Shoulberg and R. H. Tuft *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 25-37 refs Prepared for JPL (See N72-26860 17-32)
(Contract JPL-952314)
(NASA-CR-127004) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 14B

N72-26873 Radiation, Inc., Melbourne, Fla.
A ROTATIONAL SHOCK AND VIBRATION FACILITY
R. T. Fandrich, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 125-130 (See N72-26860 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26900*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TRANSONIC ROCKET-SLED STUDY OF FLUCTUATING SURFACE-PRESSURES AND PANEL RESPONSES
Eric E. Ungar (Bolt Beranek and Newman, Inc., Cambridge, Mass.), Harry J. Bandgren, Jr., and Robert Erwin *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 201-212 refs (See N72-26882 17-32)
(NASA-TM-X-68468) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 14B

N72-26631# Ohio State Univ., Columbus. Dept. of Physics.
A COMPACT POLARIZED ION SOURCE FOR THE HIGH VOLTAGE TERMINAL OF THE OHIO STATE UNIVERSITY 6-MeV VAN DE GRAAFF ACCELERATOR
H. P. Schieck, C. E. Busch, J. A. Keane, and T. R. Donoghue *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 263-267 refs Sponsored in part by NSF (See N72-26593 17-25)
Avail: NTIS HC $10.50

N72-26636# Tokyo Shibaura Electric Co., Ltd. (Japan). Electrical and Nuclear Engineering Lab.
DIRECT EXTRACTION NEGATIVE ION SOURCE FOR THE TANDEM ACCELERATOR
Seizo Masuda *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 289-294 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

N72-26637# Wisconsin Univ., Madison.
NEGATIVE ION SOURCES FOR THE UNIVERSITY OF WISCONSIN'S TANDEM ACCELERATOR
H. T. Richards *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 295-297 refs Sponsored in part by AEC (See N72-26593 17-25)
Avail: NTIS HC $10.50

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N72-26216 National Lending Library for Science and Technology, Boston Spa (England).
WIND TUNNEL INVESTIGATION OF THE PRESSURE DISTRIBUTION ON A FLAT ROOF WITH DIFFERENT EDGE PROFILES
B. Wiren 30 Mar. 1972 79 p refs Transl. into ENGLISH from the Swedish report 35:1970
(NLL-Lib-Comm-1606-(5196)) Avail: Natl. Lending Library, Boston Spa, Engl.: 8 NLL photocopy coupons

The test was carried out in a 2.1 X 1.5 m low velocity wind tunnel with a block-shaped building model, the geometry of which was representative of a modern industrial building. The study of the roof edge effects was supplemented by two tests of an exploratory nature designed to study the effect on the pressure distribution on the roof of the ratio between the model length and the model height, and also the ratio between the ground boundary layer thickness and the height of the model.
Author

N72-26217 Washington Univ., Seattle.
THE NUMERICAL CALCULATION OF PLANE STEADY TRANSONIC FLOWS PAST THIN LIFTING AIRFOILS Ph.D. Thesis
James Allan Krupp 1971 131 p
Avail: Univ. Microfilms Order No. 71-28434

Numerical solutions of the transonic potential equation for flow past lifting airfoils with free stream Mach number less than unity are presented. The work is based on the method of Murman and Cole (1970). Modifications to the basic finite difference equations are discussed which yield improved resolution of weak shock waves and greater accuracy near the sonic line. The proper treatment of boundary conditions and the Kutta condition are discussed in detail. Extensive computations for four airfoils are presented and the results are compared with theory and experiment where applicable.
Dissert. Abstr.

N72-26218 Polytechnic Inst. of Brooklyn, N.Y.
FLOW FIELD DIAGNOSTICS IN RAREFIED SLIGHTLY IONIZED HYPERSONIC FLOW Ph.D. Thesis
Joel Moshe Avidor (Oberndorfer) 1971 126 p
Avail: Univ. Microfilms Order No. 71-29026

An experimental investigation was carried out in a hypersonic shock tunnel in which two diagnostic techniques, the cylindrical electrostatic probe and the electron beam density probe, were applied to flow field surveys in rarefied slightly ionized hypersonic flow. Their relative merits were evaluated. It was found that both can be applied for flow field nvestigations and particularly, density tracing and mapping, provided that diffusion effects are nonexistent or negligible. Ion and neutral density profiles normal to a sharp flat plate and in the near wake of a 10 deg half angle cone were obtained. The ambipolar diffusion flux of the ionized particles to the plate was also measured. A comparison with theoretical results obtained using the Rudman-Rubin formulation for the hypersonic flow about a sharp flat plate modified for slightly ionized flow was carried out. Dissert. Abstr.

N72-26219 Tennessee Univ., Knoxville.
ANALYSIS OF TRANSONIC FLOW FIELD AROUND BODIES OF REVOLUTION Ph.D. Thesis
Kinya Aoyama 1971 177 p
Avail: Univ. Microfilms Order No. 71-29449

Several approximate methods were developed to calculate the inviscid transonic flow over various slender bodies of revolution. The emphasis was centered on the ogive cylinder and the cone cylinder configurations. The newly developed nonlinear-linear stretching method based on nonlinear correction theory, which allows the shock wave in the solution, was utilized to calculate the flow along the ogive cylinder. The transonic flow field has been treated including the body at small angle of attack. The sensitivity of various parameters in transonic flow is identified and discussed. A transonic flow theory for a conical geometry was developed to determine the flow along the nose cone of a body of revolution. Dissert. Abstr.

N72-26220 Washington Univ., Seattle.
AN INVESTIGATION OF THE UNSTEADY FLOW PROPERTIES OF THE INTERACTION BETWEEN A SHOCK WAVE AND A TURBULENT BOUNDARY LAYER IN TWO DIMENSIONAL INTERNAL FLOW Ph.D. Thesis
Edvard Grande 1971 335 p
Avail: Univ. Microfilms Order No. 71-28409

An experimental investigation was conducted to determine the fluctuating properties associated with the interaction between an oblique shock wave and a turbulent boundary layer. The experimental configuration consisted of a uniform flow test section located down-stream from a convergent-divergent nozzle. The experimental study included investigation of the effects of boundary layer suction on the fluctuation characteristics of the interaction region. The variations in mean flow properties throughout the interaction region were determined from static pressure measurements on the wall under the interaction boundary layer and from pitot pressure survey measurements. Dissert. Abstr.

N72-26221 Virginia Polytechnic Inst., Blacksburg.
CALCULATION OF INVISCID AND VISCID FLOW FIELDS PAST POINTED BODIES AT ANGLES OF ATTACK IN SUPERSONIC NONUNIFORM FREESTREAMS Ph.D. Thesis
Frankie Gale Moore 1971 141 p
Avail: Univ. Microfilms Order No. 71-28948

Free stream velocity profiles considered were those representative of an axisymmetric wake, two-dimensional wake, and a two-dimensional shear flow. Applications were made to cones with half angles varying from 10 to 40 degrees, free stream Mach numbers 2 to 8, angles of attack of 2 to 22 degrees, and free stream velocity defects of 5 to 20 percent. Results indicated that a strong adverse pressure gradient and entropy layer existed along the body surface in some cases. In cases where this entropy layer is strong the inviscid surface Mach number becomes unity so that the method of characteristics can not be applied beyond this point. The numerical results of the inviscid cases computed were presented in terms of the surface Mach number and pressure distributions; meridional and cross flow shock angles; crossflow angle; lift, drag, and pitching moment coefficients; and normal force and pitching moment slope coefficients. It was found that all these parameters were severely affected by the nonuniform freestream. Dissert. Abstr.

N72-26222 California Univ., San Diego.
TURBULENCE IN CONSTANT DENSITY FLUIDS WITH THERMAL FLUCTUATIONS Ph.D. Thesis
Paavo Sepri 1971 345 p
Avail: Univ. Microfilms Order No. 71-28502

The central problem under investigation deals with fluid turbulence generated by a heated grid in a low speed wind tunnel. Temperature fluctuations resulting from heating the grid are convected downstream as a passive scalar field. Experimental data are presented for both velocity and thermal turbulence in the form of energy spectra, correlation functions, phase measurements, and downstream decay of turbulence intensity. Of these measurements, the ones that are novel involve temperature cross correlations in which signals in time are analyzed from probes separated spatially. Although some unexpected differences arose between the velocity and temperature signals, the results which can be compared are on the whole in agreement with measurements reported by previous investigators Dissert. Abstr.

N72-26223 Georgia Inst. of Tech., Atlanta.
TWO APPROACHES TO THE THREE-DIMENSIONAL JET-IN-CROSS-WIND PROBLEM: A VORTEX LATTICE MODEL AND A NUMERICAL SOLUTION OF THE NAVIER STOKES EQUATIONS Ph.D. Thesis
Joe Floyd Thompson, Jr. 1971 551 p
Avail: Univ. Microfilms Order No. 71-28109

A three-dimensional numerical solution of the timedependent, incompressible Navier-Stokes equations based on an integro-differential formulation of these equations is developed. With this formulation it is possible to obtain the complete solution in the entire flow field while restricting the actual computational field to the region of significant vorticity magnitude at each time. This allows a considerable reduction in the computer storage required, since only the field points having significant vorticity at any time need be stored at that time, and calculation are actually performed only at those points at that time. The validity of the numerical solution is established by comparison of the results with the exact solution for the time-dependent, one-dimensional flow over a suddenly accelerated infinite flat plate moving parallel to itself at constant velocity. Dissert. Abstr.

N72-26224 Georgia Inst. of Tech., Atlanta.
EXPERIMENTAL STUDY OF TWO DIMENSIONAL TURBULENT WALL JET DEVELOPMENT WITH AND WITHOUT LONGITUDINAL FREE STREAM PRESSURE GRADIENT Ph.D. Thesis
Douglas Howard Neale 1971 285 p
Avail: Univ. Microfilms Order No. 71-28101

An experimental study of various wall jet flows was conducted. The major areas of investigation were: (1) the wall jet injected into still air; (2) the wall jet under a constant-pressure main-stream flow; (3) the wall jet subjected to an adverse pressure gradient imposed by a retarded main-stream flow with a substantially thickened initial boundary layer; (4) the wall jet subjected to an adverse pressure gradient imposed by a retarded main-stream flow with a thickened and distorted initial boundary layer. The growth of characteristic thickness and decay of jet peak velocity is presented for all wall jet studies. In addition, velocity and temperature profile similarity is described. Skin friction and velocity profile measurements are presented in tabular form. Dissert. Abstr.

N72-26225 New York Univ., N.Y.
THREE DIMENSIONAL SUPERSONIC FLOW OVER A SMOOTH BODY WITH SHOCK-PRODUCING PROTUBERANCE Ph.D. Thesis
Richard Albert Scheuing 1971 186 p
Avail: Univ. Microfilms Order No. 71-29690

Nonlinear solution is considered for the three dimensional, supersonic flow field around an arbitrarily shaped body, which, although otherwise of smooth contour, has a protuberance that generates a shock wave and substantially disturbs the flow downstream. The calculation of the flow field about a body with no local protuberance is considered first. The solution is based on the so-called method of near-characteristics (or reference plane method). The compatibility relations, which prescribe the variation of the local velocity components along the near characteristics, are derived in circular cylindrical coordinates. Typical numerical results are presented for circular and elliptic cones, tangent ogives of circular and elliptic cross section, and a representative nonaxisymmetric compression surface. The theoretical analysis and computational procedure evolved for the arbitrarily shaped but smooth body (the primary body) was extended to permit the addition of a shock-producing-protuberance (referred to as the secondary body). A computational program for the case of a secondary body mounted on a cylindrical primary body (of arbitrary cross section) extending to + or - infinity is described in detail. Dissert. Abstr.

N72-26226 Colorado State Univ., Fort Collins.
NUMERICAL AND WIND TUNNEL SIMULATION OF RESPONSE OF STRATIFIED SHEAR LAYERS TO NONHOMOGENEOUS SURFACE FEATURES Ph.D. Thesis
Tetsuji Yamada 1971 250 p
Avail: Univ. Microfilms Order No. 71-28088

Two-dimensional airflows over various nonuniform surfaces in a stratified atmosphere are studied both numerically and experimentally. Three problems are investigated, classified by the effect of the external forcing functions upon the basic airflow. They are: (1) mountain lee waves; (2) heat islands (sea breezes are included here); and (3) heated mountain phenomena in a stratified airflow. Both numerical and wind tunnel experiments succeed in producing clear lee waves behind the square obstacle. The amplitude of the first wave is about the same order of magnitude as the obstacle height, and wave length closely agrees with that predicted by the linear theory.
Dissert. Abstr.

N72-26227*# Vanderbilt Univ., Nashville, Tenn. Dept. of Mechanical Engineering.
A STUDY OF JET IMPINGEMENT ON CURVED SURFACES FOLLOWED BY OBLIQUE INTRODUCTION INTO A FREESTREAM FLOW Annual Status Report, 1 Feb. 1971 - 31 Jan. 1972
John W. Tatom, Norman M. Schnurr, John W. Williamson, and John H. Dunlap 29 Mar. 1972 148 p refs
(Grant NGR-43-002-034)
(NASA-CR-127121; AR-2) Avail: NTIS HC $9.50 CSCL 20D

An experimental investigation of the temperature and velocity fields generated by a two-dimensional transverse jet was conducted. An approximate analysis of a deflected radial plane jet was developed. An analytical model of aircraft ingestion was extended to include computation of the inlet flow field. An investigation of the use of flaps as thrust reversers was initiated. Analyses of the impingement of a round incompressible and a round compressible jet on a arbitrary axisymmetric surface were completed. A computer study of the effects on performance of thrust reverser geometry was completed and the results compared with existing data. An experimental investigation of three-dimensional jet impingement on nonplane surfaces was also initiated. Author

N72-26228*# New York Univ., N.Y. Daniel Guggenheim School of Aeronautics.
AN EXPERIMENTAL INVESTIGATION OF VORTEX GENERATION IN A TURBULENT BOUNDARY LAYER UNDERGOING ADVERSE PRESSURE GRADIENT
Victor Zakkay and Wladimiro Calarese Washington NASA Jun. 1972 43 p refs
(Grant NGR-33-016-184)
(NASA-CR-2037) Avail: NTIS HC $3.00 CSCL 20D

The existence of streamwise vortices in nominally 2-dimensional boundary layers undergoing adverse pressure gradient was investigated. The free stream Mach number was 5.75, the wall to stagnation temperature ratio was 0.63 and the Reynolds number based on free stream conditions was 3.9 x 10 to the 7th power/ft. The model consisted of an axisymmetric compression flare preceded by a cylindrical axially symmetric body. A natural turbulent boundary layer was established well ahead of the compression region. Boundary layer profiles of static pressure, pitot pressure, and stagnation temperature were taken at a surface station with a local inclination of 20 deg. Profile measurements were obtained at various peripheral stations. The measurements revealed zero peripheral variations at the surface of the body and at the edge of the boundary layer. However, distinct wavy pressure variations were observed within the boundary layer profiles, indicating the existence of longitudinal vortex cells within the boundary layer. Author

N72-26229*# Princeton Univ., N.J.
COMPUTER PROGRAM FOR CALCULATING LAMINAR AND TURBULENT BOUNDARY LAYER DEVELOPMENT IN COMPRESSIBLE FLOW
H. J. Herring and G. L. Mellor Washington NASA Jun. 1972 95 p refs
(Grant NGR-31-001-074)
(NASA-CR-2068) Avail: NTIS HC $3.00 CSCL 20D

A computer program is described which performs a numerical integration of the equations of motion for a compressible two-dimensional boundary layer. Boundary layer calculations may be carried out for both laminar and turbulent flow for arbitrary Reynolds number and free stream Mach number distribution on planar or axisymmetric bodies with wall heating or cooling, longitudinal wall curvature, wall suction or blowing, and a rough or a smooth wall. A variety of options are available as initial conditions. The program can generate laminar initial conditions such as Falkner-Skan similarity solutions (so that initial wedge flows can be simulated including Blasius or stagnation point flow) or approximate equilibrium turbulent profiles. Alternatively, initial profile input data can be utilized. Author

N72-26230# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
TRAJECTORIES OF RAINDROPS IN A JET ISSUING INTO A NORMAL CROSSWIND
G. A. S. Allen and R. T. Lake Nov. 1971 37 p refs
(UTIAS-TN-165) Avail: NTIS HC $4.00

Numerical solutions are presented to the motion equations of solid spheres simulating raindrops falling into a plane jet entering a normal crosswind. The results of these computations are discussed in terms of their significance for air curtain type devices. This includes a discussion of basic scaling laws and some order of magnitude estimates of the power requirements.
Author

N72-26231# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
EXPERIMENTAL INVESTIGATION OF A CURTAIN FOR PROTECTION OF OUTDOOR POWER INSTALLATIONS FROM SALT SPRAY
G. A. S. Allen Aug. 1971 40 p refs
(UTIAS-TN-171) Avail: NTIS HC $4.00

An experimental investigation was carried out in a subsonic wind tunnel of the applicability of an air curtain to protect outdoor electric power installations from wind-borne salt spray. The salt emanates from an elevated roadway that is salted in the winter, being thrown up by passing traffic. The salt was simulated by a tracer gas (helium), the concentrations of which were measured in the region to be protected. The investigation indicates that reductions of the order of 70% in contamination can be achieved. Author

N72-26232*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

BOUNDARY LAYER LOSS SENSITIVITY STUDY USING A MODIFIED ICRPG TURBULENT BOUNDARY LAYER COMPUTER PROGRAM

Satoaki Omori (NAS-NRC, Washington, D. C.), Alfred Krebsbach, and Klaus W. Gross 3 Mar. 1972 52 p refs
(NASA-TM-X-64661) Avail: NTIS HC $4.75 CSCL 20D

Modifications of the turbulent boundary layer (TBL) computer program refer to a more accurate representation of boundary layer edge conditions, internal calculation of the Prandtl number, a changed friction coefficient relationship, and computation of the performance degradation. Important input parameters of the modified TBL program such as wall temperature distribution, Prandtl number, Stanton number, and velocity profile exponent were changed and the individual effects on significant boundary layer parameters, heat transfer, and performance degradation are described. Author

N72-26233*# Scientific Translation Service, Santa Barbara, Calif.

AIR VORTEX WAKES AND THEIR CAUSE

Washington NASA Jun. 1972 29 p refs Transl. into ENGLISH of Luftwirbelschleppen und Was Dahinter Steckt West Ger., Verband Deut. Flugleiter E. V., 1971 24 p
(Contract NASw-2035)
(NASA-TT-F-14286) Avail: NTIS HC $3.50 CSCL 20D

The dangers of air vortex wakes caused by jumbo jets such as the B-747 to air traffic are discussed. The effects of these wakes on other aircraft is described and safety measures are presented. Author

N72-26234*# Scientific Translation Service, Santa Barbara, Calif.

EXPERIMENT ON EXHAUST MUFFLER BY PULSATING AIR FLOW

S. Fujimoto Washington NASA Jun. 1972 27 p refs Transl. into ENGLISH from Nippon Onkyo Gakkaishi (Tokyo), v. 27, no. 11, 1971 p 568-578
(Contract NASw-2035)
(NASA-TT-F-14295) Avail: NTIS HC $3.50 CSCL 20D

The silencing effect is studied of exhaust mufflers for automobiles. The purpose of this experiment was to investigate the effect of the flow rate of an exhaust gas on the changes in noise attenuation in mufflers from the practical point of view. Ten fundamental types of reactive mufflers are tested by an engine, which has a cylinder volume of about 900 cc. The results are compared with those of a test by pulsating air flow at various flow rates. In general, the sound level in the pulsating flow test is lower in the low frequency range, but higher in the high frequency range. The noise attenuation in the engine test varies with engine load, and is generally lower under full load than in no load condition, especially in the high frequency range above 300 Hz. Author

N72-26235# Aeronautical Research Council (England).

SOME COMMENTS ON AIR CONDENSATION EFFECTS IN A HYPERSONIC HELIUM-TUNNEL

L. Davies and J. E. G. Townsend 1971 19 p refs Supersedes NPL-Aero-1316-ARC-32118
(ARC-R/M-3666; NPL-Aero-1316-ARC-32118) Avail: NTIS HC $3.00; HMSO 55p; PHI $2.35

The effects of small amounts of air contamination in helium flow in a hypersonic nozzle are discussed. A brief theoretical analysis of these effects was carried out using several simplifying assumptions. Author

N72-26236# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Werkstoff-Forschung.

EQUIPMENTS FOR STUDYING THE POTENTIAL BEHAVIOUR OF THE INTERFACE OF METALLIC MATERIALS AT MILD AND STRONG VIBRATORY CAVITATION

F. C. Althof and H. Voigt 21 Dec. 1971 37 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-103) Avail: NTIS HC $4.00; DFVLR Porz-Wahn: 12,70 DM

In the case of moving liquids in metallic structural materials, or of such materials in liquids, different surface stresses of the material may occur. These stresses can be either mechanical or corrosive in nature or both, depending on the forces operating and the nature of the liquid. The equivalent of these forces is acceleration with a range from zero to 100,000 g, for sinusoidal oscillations of cylindrical specimens in liquids, taken as a basis for vibratory cavitation. The potential behavior at vibratory cavitation is considered as an example. Author

N72-26237# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).

HEAT ADDITION IN SUPERSONIC FLOW BY MEANS OF HYDROGEN COMBUSTION ON A FLAT PLATE IN TANGENTIAL FLOW

F. Maurer 1972 65 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-12) Avail: NTIS HC $5.25; DFVLR Porz-Wahn: 20,30 DM

The problem of external heat addition in supersonic flow for producing aerodynamic forces was studied, supplemented by one dimensional momentum analyses, for the flow field on a flat plate in tangential flow. Secondary air injection through a slot nozzle was used for creating upstream and downstream recirculation zones. By adding hydrogen to the upstream flow and igniting by a spark device, a stable flame was produced and the magnitude of the upstream recirculation zone is increased drastically; the point of boundary layer separation was shifted upstream correspondingly. Pressure distributions were measured and they provide information on the acting cross forces. Interpreting schlieren and flame picture flow models were deduced, which help to estimate these forces for engineering purposes. Author

N72-26238*# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.

INVESTIGATION OF MASS TRANSFER BETWEEN TWO PARALLEL WALLS AT DIFFERENT TEMPERATURES BY A MOMENT METHOD

T. N. Sloat, R. H. Edwards, and R. L. Collins Jan. 1971 149 p refs
(Grant NGL-05-018-044)
(NASA-CR-127029; USCAE-120) Avail: NTIS HC $9.50 CSCL 20D

One-dimensional flow between two fixed parallel walls composed of the same substance but at different temperatures and spaced a distance 1 apart is considered. The hot plate is the evaporating surface (source) and the cold plate is the condensing surface (sink). The vapor between the two plates is assumed to be a monatomic gas consisting of Maxwell molecules. Lee's moment method is used to obtain a set of six nonlinear equations. Both the nonlinear equations and a linearized approximation to them are solved. Author

N72-26239*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A SURVEY OF NASA LANGLEY STUDIES ON HIGH-SPEED TRANSITION AND THE QUIET TUNNEL

Ivan E. Beckwith and Mitchel H. Bertram Washington Jul. 1972 67 p refs
(NASA-TM-X-2566; L-8311) Avail: NTIS HC $3.00 CSCL 20D

A quantitative experimental and theoretical assessment of the role of wind-tunnel disturbances in the boundary-layer transition process at hypersonic speeds is presented. The various approaches and recent results for the development of a low-noise-level tunnel are presented. A statistical parametric study of transition data with a large computer is shown for cones in free flight, ballistic ranges, and wind tunnels at essentially zero angle of attack. New transition results for slender cones at small angle of attack are also given, as are studies of transition at high angle of attack, which are compared with various correlation attempts. Included are results which indicate that hypersonic transition in the outer part of the boundary layer precedes the manifestation of transition at the wall. Author

N72-26240*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ATOMIZATION, DROP SIZE, AND PENETRATION FOR CROSS-STREAM WATER INJECTION AT HIGH-ALTITUDE REENTRY CONDITIONS WITH APPLICATION TO THE RAM C-1 AND C-3 FLIGHTS

Paul B. Gooderum and Dennis M. Bushnell Washington Jul. 1972 53 p refs
(NASA-TN-D-6747; L-8004) Avail: NTIS HC $3.00 CSCL 20D

Atomization, drop size, and penetration data are presented for cross stream water injection at conditions simulating high altitude reentry (low Weber number, high static temperature, high Knudsen number, and low static pressure). These results are applied to the RAM C-1 and C-3 flights. Two primary breakup modes are considered, vapor pressure or flashing and aerodynamic atomization. Results are given for breakup boundaries and mean drop size for each of these atomization mechanisms. Both standard and flight orifice geometries are investigated. The data were obtained in both a static environment and in conventional aerodynamic facilities at Mach numbers of 4.5 and 8. The high temperature aspects of reentry were simulated in a Mach 5.5 cyanogen-oxygen tunnel with total temperature of 4500 K. Author

N72-26241# National Aeronautical Establishment, Ottawa (Ontario). Low Speed Aerodynamics Section.

THE TRAILING VORTEX WAKE AND DOWNWASH BEHIND A QUASI-TWO-DIMENSIONAL EXTERNAL FLOW JET FLAP

R. H. Wickens Nov. 1971 31 p refs
(LTR-LA-85) Avail: NTIS HC $3.75

The results are presented for flow traverses downwind of a quasi-two-dimensional externally flown flap. Since it was apparent that the flow behind the wing was composed of both propulsive and vortical components, it was decided to perform the flow survey with a five-hole probe, so as to achieve as complete a description as possible of the flow field. Author

N72-26242*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF EDDY DIFFUSIVITY ON WIND-DRIVEN CURRENTS IN A TWO-LAYER STRATIFIED LAKE

Richard T. Gedney, W. Lick, and Frank B. Molls Washington Jun. 1972 38 p
(NASA-TN-D-6841; E-6776) Avail: NTIS HC $3.00 CSCL 20D

The steady state wind-driven circulation was numerically calculated in a rectangular stratified lake. The lake is composed of two layers having uniform but unequal densities and eddy diffusivities. The position in thermocline and the three-dimensional velocities in both layers calculated using shallow lake equations. The results show that, as the eddy diffusivity in the hypolimnion is increased, the thermocline tilt and hypolimnetic velocities increase. The effect of the other variables such as wind stress, density, basin length, and mean thermocline depth are also shown. Author

N72-26243*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ANALYSIS OF A TURBULENT BOUNDARY LAYER OVER A MOVING GROUND PLANE

Alan T. Roper and Garl L. Gentry, Jr. Washington Jul. 1972 72 p refs
(NASA-TN-D-6788; L-7872) Avail: NTIS HC $3.00 CSCL 20D

Four methods of predicting the integral and friction parameters for a turbulent boundary layer over a moving ground plane were evaluated by using test information obtained in 76.2- by 50.8-centimeter tunnel. The tunnel was operated in the open sidewall configuration. These methods are (1) relative integral parameter method, (2) modified power law method, (3) relative power law method, and (4) modified law of the wall method. The modified law of the wall method predicts a more rapid decrease in skin friction with an increase in the ratio of belt velocity to free steam velocity than do methods (1) and (3). Author

N72-26244# Asian Inst. of Tech., Bangkok (Thailand).

FORCES ON PIPE ENTRANCE M.S. Thesis

Amnuay Saingern 1970 93 p refs
(AIT-Thesis-326) Avail: NTIS HC $6.75

To separate the entrance pipe and wall from the remainder of the flow system, for the purpose of measuring the force on it, discharge was effected by a jet located at the entrance. Velocities were measured by pitot tube and force by pressure take-offs around the flared entrance, besides total force on the inlet and wall by a force transducer meter. Guide vanes between the entrance and the wall permitted various degrees of vorticity in the flow. Conditions for optimal force were examined. The theoretical value for the force from the momentum equation agreed with the experimental values for radial flow. Author

N72-26245# Asian Inst. of Tech., Bangkok (Thailand).

TURBULENT FLOW OF GAS THROUGH POROUS MEDIA M.S. Thesis

Kok Ah Chiew 1970 76 p refs
(AIT-Thesis-330) Avail: NTIS HC $6.00

Characteristics of laminar and turbulent flow of air through porous media were studied. The flow characteristics were investigated as a non-dimensional relationship between friction factor and Reynolds number. An expression of the hydraulic radius of a porous medium was developed to be used as the characteristic length of the pore spaces of the medium in defining the friction factor and Reynolds number. The expression of the hydraulic radius was derived in terms of the following physical properties of the porous medium: (1) porosity, (2) permeability, (3) tortuosity, (4) shape factor of the flow channel, and (5) coefficient of variance of the pore-size distribution. The derivation was made using the concept of the flow through pipes of non-circular cross-section. An empirical equation relating friction factor and Reynolds number for laminar and turbulent flow of compressible and incompressible fluid in porous media was obtained using Darcy's law and experimental results. Author

N72-26246# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

OUTLINE OF SOME NEW RESULTS OBTAINED AT ONERA ON SEPARATION AND REATTACHMENT PHENOMENA

Pierre Carriere 1972 36 p refs In FRENCH; ENGLISH summary Presented at Ann. Sic. Meeting of GAMM, Ljubljana, Yugoslavia, 4-8 Apr. 1972
(ONERA-TP-1072) Avail: NTIS HC $4.00

The methods proposed to solve the very important problem of supersonic turbulent separation, followed by reattachment, are of two kinds: integral methods based on the classical assumptions of the boundary layer (Prandtl), and global methods based on the use of criteria resulting from a correlation of experimental results. An experiment concerning the behavior of a propulsive nozzle jet whose exhaust section is more or less inserted within the afterbody shroud is described. Author

N72-26247# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

GENERATION OF ULTRA-HIGH TOTAL ENTHALPY GASES

THROUGH MULTICOMPONENT FLOW TECHNIQUES
Elmer G. Johnson and Hans J. P. vonOhain 18 Jul. 1972 12 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Nov. 1972
Avail: NTIS HC $3.00

A steady multicomponent flow process is analyzed by which kinetic energy is transferred from a low molecular weight gas to a higher molecular weight working medium. It is shown that by this process air flows of ultra high stagnation pressures, temperatures and Mach numbers, applicable for simulation of reentry conditions in wind tunnels, can be generated without going through phases of high static pressures or temperatures. Two types, the direct and the intermediate energy transfer processes and their associated problems, as well as research approaches to their solutions, are discussed. Author

N72-26248# Argonne National Lab., Ill. Engineering and Technology Div.
DROPLET TRANSPORT IN TURBULENT PIPE FLOW Ph.D. Thesis - Pa. State Univ., University Park
Theodore Ginsberg Nov. 1971 148 p refs
(Contract W-31-109-eng-30)
(ANL-7694) Avail: NTIS

Analytical and experimental investigations of the Fick's law diffusion model of turbulent droplet transport are described. The turbulent diffusion model is applied to the transport of liquid droplets in the central core region of fully developed turbulent pipe flow. The Fick's law formulation is defined, and its implications are discussed. The particle diffusivity is defined in terms of the statistical properties of the particulate motion. The momentum equations for a single particle moving in a turbulent fluid are presented. An expression for the particle diffusivity is obtained for the case of a particle falling with terminal velocity greater than the rms turbulent fluid velocity. A study of droplet transport in turbulent pipe flow was carried out. Water droplets, introduced into the center of a pipe, flowed vertically downward and concurrently with the air flow. A droplet generator was fabricated which produced a continuous stream of uniform size droplets with known diameter. Author (NSA)

N72-26249# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ON CERTAIN TYPES OF SHEAR FLOW OF IDEAL INCOMPRESSIBLE FLUID Ph.D. Thesis - Paris Univ.
Jean-Jacques Lautard 1971 40 p refs In FRENCH; ENGLISH summary
(ONERA-NT-182) Avail: NTIS HC $4.00

A computation method for steady rotational flows of an ideal incompressible fluid is presented based on the analytical determination of streamlines. Some problems of rotational flows are solved, outlining the essential characters of these flows. A whole class of two-dimensional flows ruled by the Helmholz equation are computed. The complex wave system in three dimensional space, initiated by a small irregularity of one of the four walls of a rectangular cross-section duct, is computed for a given distribution of the shear velocity at infinity upstream (linearized problem). Author (ESRO)

N72-26250# Queen Mary Coll., London (England).
THE MULTIPLE QUANTUM JUMP MODEL FOR VIBRATIONAL ENERGY RELAXATION
Michael J. Lewis and Leonard Bernstein Aeron. Res. Council 1972 34 p refs Supersedes ARC-32525 Sponsored by Min. of Technol.
(ARC-CP-1191) Avail: NTIS HC $3.75; HMSO 62 p; PHI $2.65

An analysis is given of the vibrational energy relaxation rates in expanding flow for a simple diatomic gas, assuming that multiple quantum jumps are allowed between vibrational states. This is an attempt to account for the anomaly concerning the faster vibrational energy relaxation rates observed for some gases in expanding flows, rates that are inferred from data measured in shock-excited environments. The relaxation rates are shown to depend upon the vibrational, as well as the translational, temperature. Rates calculated for nitrogen show the de-excitation rates in a nozzle expansion to be faster than the excitation rates in a shock excited environment at the same translational temperature, but by an amount far less than that observed experimentally. Author (ESRO)

N72-26251# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
REVIEW OF MIT RESEARCH ON AIRFOIL DYNAMICS STALL 1964 - 1971
Norman D. Ham Sep. 1971 33 p refs
(Contract DA-31-124-ARO(D)-247)
(AD-738610; ASRL-TR-130-3; AROD-4846:13-E) Avail: NTIS CSCL 20/4

Research on the dynamic stall of airfoils and helicopter blades is described, beginning with wind tunnel tests and helicopter flight tests which led to the current research. Flutter criteria, tests of two-dimensional airfoils undergoing large transient motions, and a partial theory of airfoil dynamic stall are presented. The application of the two-dimensional results to the loading and motion of rotor blades due to stall is described. Unsteady boundary layer analyses and tests, and their relationship to the development of a complete flow separation model, to airfoil design, and to blade-vortex interaction effects are summarized. GRA

N72-26252# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE WAKE REGION OF THE FLOW OF DILUTE POLYMER SOLUTION ABOUT CIRCULAR CYLINDERS M.S. Thesis
John Norman Schimmels Dec. 1971 152 p refs
(AD-738914) Avail: NTIS CSCL 20/4

The wake region of the flow of dilute polymer solution about a circular cylinder was studied. Polyox WSR-301 at a concentration of 25 WPPM was dissolved in tap water. The investigation was performed in the drag transition flow regime. Turbulence intensity, wake width, microscale of turbulence and frequency spectra were measured at various points in the wake region of water flow and polymer solution flow. Author (GRA)

N72-26253# Ocean and Atmospheric Science, Inc., Dobbs Ferry, N.Y.
SOME COMMENTS ON THE MODELING OF THE TURBULENT WAKE OF A SELF PROPELLED BODY IN A STRATIFIED FLUID
Edward Y. T. Kuo and Chester E. Grosch Mar. 1972 14 p refs
(Contract N00014-72-C-0127; ARPA Order 1910)
(AD-738866; OAS-TR-72-073) Avail: NTIS CSCL 20/4

The modeling of the turbulent wake of a self-propelled body in a stratified fluid is discussed. The scaling parameter is taken to be the internal Froude number, using the speed and diameter of the body and Vaisala frequency of the fluid. The ratio of the time for the wake to collapse to the characteristic time of the turbulence is related to model scale when the wake is turbulent up to and including the collapse. A number of criteria for turbulent wake is discussed. Numerical estimates are made, assuming typical values of the model speed and of the Vaisala frequency, and of the minimum model size necessary for the existence of a turbulent wake at collapse. GRA

N72-26254# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
ANALYTICAL INVESTIGATION OF CONFINED TURBULENT MIXING OF JETS
Kirti N. Ghia Jan. 1972 61 p refs
(Contract DAHC04-69-C-0016)
(AD-738554; THEMIS-AE-72-24; AROD-T-4:42-E) Avail: NTIS CSCL 20/4

The turbulent mixing of confined axisymmetric incompressible jets was studied, using the turbulent boundary layer equations in terms of transformed von Mises variables, with semi-empirical formulations of the turbulent transport coefficients. The solution was obtained by the method of finite differences. Analytical predictions of the jet mixing flow fields were obtained for several configurations, covering a reasonably wide range of values of the problem parameters. A turbulent mixing model which satisfactorily predicts mean flow profiles for a reasonably broad spectrum of flow conditions has been formulated. GRA

N72-26255# Naval Postgraduate School, Monterey, Calif.
PROPELLER CAVITATION IN SOLUTIONS OF POLYETHYLENE OXIDE M.S. Thesis
Robin John White Dec. 1971 36 p refs
(AD-738893) Avail: NTIS CSCL 13/10

The inception and formation rates of bubble cavitation on a 14.8 cm diameter, two-bladed propeller were measured in homogeneous aqueous solutions of polyethylene oxide. If the results can be extended to full size propellers, ships can increase their propeller rotation rate while producing the same amount of cavitation noise. Measurements of the radiated noise spectra of bubble collapses showed how the higher frequency components are somewhat attenuated in polyethyleneoxide solutions. Author (GRA)

N72-26256# Naval Ship Research and Development Center, Bethesda, Md.
HOLOGRAPHIC DISPLACEMENT MEASUREMENTS ON A HIGHLY SKEWED PROPELLER BLADE
Surendra K. Dhir and Jerome P. Siktra Aug. 1971 25 p refs
(AD-738820; NSRDC-3680) Avail: NTIS CSCL 20/4

Static deflections were measured on a highly skewed marine propeller blade model using holographic interferometry. A specially designed pressure chamber was used to load the blade model under uniform air pressure from one side. The method that was used to predict the three-dimensional displacements from the holographic fringes is developed and described. The holographic displacement results were studied for favorable correlation with those from a finite element analysis. GRA

N72-26257# ARO, Inc., Arnold Air Force Station, Tenn.
EFFECTS OF WALL COOLING AND LEADING EDGE BLUNTING ON RAMP-INDUCED, LAMINAR FLOW SEPARATIONS AT MACH NUMBERS FROM 3 THROUGH 6 Final Report, 30 Nov. 1970 - 16 Apr. 1971
J. Don Gray and R. W. Rhudy AEDC Mar. 1972 119 p refs
(Contract F40600-72-C-0003; ARO Proj. VT0036)
(AD-738644; ARO-VKF-TR-71-199; AEDC-TR-71-274) Avail: NTIS CSCL 20/4

The effects of wall cooling and nose bluntness on laminar and transitional reattaching flows induced by a 9.5 degree ramp were investigated at Mach numbers from 3 through 6 by measuring the longitudinal surface pressure and heat transfer rate distribution, as well as the flow field pressure, at several longitudinal stations. Reynolds number based on flat plate length was varied from 0.25 to 1.0 million. It was determined that wall cooling always reduced the interaction extents. Peak heating rates generally were dominated by transition onset and were reasonably close to predicted turbulent levels. Tabulated surface pressure and heat transfer data at minimum Reynolds number are presented. Author

N72-26258# Hydronautics, Inc., Laurel, Md.
A STUDY OF THE NONLINEAR WAVE RESISTANCE OF A TWO-DIMENSIONAL SOURCE GENERATED BODY
Gedeon Dagan Feb. 1972 36 p refs
(Contract N00014-71-C-0800; NR Proj. 062-266)
(AD-739352; TR-7103-2) Avail: NTIS CSCL 13/10

The document is concerned with the wave resistance of bodies moving beneath or at a free water surface. The second order wave resistance of a thin symmetrical two-dimensional body or source is derived in a closed analytical form. The result is applied to an isolated source representing a semi-infinite blunt body, an open body with a leading edge of a fine shape, and a closed body generated by a source and a sink. The relevance of the results to ship wave resistance is discussed in qualitative terms. GRA

N72-26259# Air Force Weapons Lab., Kirtland AFB, N.Mex.
SPSHELL, OILDROP, AND SPCLAM: THREE PROGRAMS TO SOLVE HYDRODYNAMICS PROBLEMS IN TWO DIMENSIONS Technical Report, Sep. 1969 - Aug. 1971
Robert C. Reynolds Feb. 1972 220 p refs
(AD-739354; AFWL-TR-70-96-Rev.) Avail: NTIS CSCL 20/4

Three programs have been written to solve two-dimensional hydrodynamics problems in a spherical, pure Eulerian coordinate system. An extensive analysis of the central program, SPSHELL, is given and the equations it solves are derived. A Fortran listing of each program is included with an explanation of the data deck needed to run it. Author (GRA)

N72-26881 California State Coll., Long Beach.
WALL FLOW NOISE IN A SUBSONIC DIFFUSER
E. F. Timpke and R. C. Binder (Univ. of Southern Calif., Los Angeles) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 209-216 refs
Prepared in cooperation with Univ. of Southern Calif. (See N72-26860 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26686*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMODYNAMIC AND FLUID-DYNAMIC CONCEPTS
Arthur J. Glassman *In its* Turbine Design and Appl., Vol. 1 1972 p 1-20 refs (See N72-26685 17-28)
Avail: NTIS; SOD $0.60 CSCL 20D

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N72-26260 Boston Univ., Mass.
THE BEHAVIOR OF THE MID-LATITUDE IONOSPHERE DURING GEOMAGNETIC STORMS Ph.D. Thesis
Michael Joseph Mendillo 1971 208 p
Avail: Univ. Microfilms Order No. 71-26455

By monitoring the amount of Faraday rotation a VHF radio signal experiences in traveling through the ionosphere, one can determine the integral with height of the Ne(h) profile. This quantity is called the ionospheric total electron content (TEC). Over two years worth of Faraday rotation records are used to obtain the first complete description of the TEC behavior during geomagnetic storms. The measurements pertain to a sub-ionospheric point at 39 N and 70 W. Dissert. Abstr.

N72-26261 Oregon State Univ., Corvallis.
ON THE NUMERICAL INTERPRETATION OF GRAVITY AND OTHER POTENTIAL FIELD ANOMALIES CAUSED BY LAYERS OF VARYING THICKNESS Ph.D. Thesis
George Modesto Adotevi-Akue 1971 127 p
Avail: Univ. Microfilms Order No. 71-27847

The partial differential equations of potential field theory are reviewed for gravitational and magnetic force fields. A similar review is carried out for steady state heat transport and diffusion processes. For the gravitational force fields, solutions of the partial differential equations are listed in integral form for the following cases: single body with given constant density,

infinitely thin sheet with variable mass density, two homogeneous layers with a slowly undulating interface and two layers with a vertically constant density lower layer. The solutions give the gravity anomaly in terms of the parameters of the source body. Heat transport phenomena of a similar nature are also discussed.
Dissert. Abstr.

N72-26262 Alaska Univ., College.
INTERCORRELATED SATELLITE AND GROUND OBSERVATIONS AND MODEL CALCULATIONS OF MAGNETIC STORMS Ph.D. Thesis
Koji Kawasaki 1971 327 p
Avail: Univ. Microfilms Order No. 71-29934

Studies of the quiet day geomagnetic variations are reviewed. A model for the polar quiet day variation, which is thought to be related to the formation of the magnetospheric tail, is presented. The model consists of Chapman-Ferraro boundary charges mapped onto the dayside auroral oval and the Hall currents expected of this distribution of charge. The model is consistent with the observed variation below the auroral oval, but not consistent in the polar cap. The magnetic field equations for two three-dimensional models of the known currents are listed and the results of some calculations are presented. A relatively simple model of ring, auroral electrojet, and field-aligned currents is shown to be consistent with the major part of observed disturbance field. The second of the models consists of a distributed ring current, boundary currents, and magnetotail current. This can reproduce the early recovery of a magnetic storm observed by the ATS 1 satellite. Dissert. Abstr.

N72-26263 Alaska Univ., College.
A STUDY OF THE AURORAL ABSORPTION SUBSTORM Ph.D. Thesis
Frank Thomas Berkey 1971 338 p
Avail: Univ. Microfilms Order No. 71-30073

The results of an experiment which correlated the variations of auroral light intensity with those in auroral absorption is described. These measurements were carried out over a small angular cone which intercepted an area of less than 400 sq. km at auroral heights. The spatial coherence of auroral absorption and auroral luminosity was examined, as was the correlation of absorption with auroral emission at several wavelengths. A synoptic study of the geographical distribution of auroral absorption during 5 IQSY substorms was undertaken. A cooperative study provided radio wave absorption data from more than 20 observatories in the Northern Hemisphere for this purpose.
Dissert. Abstr.

N72-26264 National Lending Library for Science and Technology, Boston Spa (England).
A TIDAL CHART OF THE PACIFIC, ATLANTIC AND INDIAN OCEANS
K. D. Tiron, Yu. N. Sergeev, and A. N. Michurin May 1972 20 p refs Transl. into ENGLISH from Vestn. Leningr Univ., Ser. Geol. i Gergr. (Leningrad), v. 24, 1967 p 123-135
(NLL-RTS-6771) Avail: Natl. Lending Library, Boston Spa, Engl: £ 1.90; 6 NLL photocopy coupons

A brief review of earlier cotidal maps of the world's oceans is presented. The rationale is given for the construction of the maps presented for the Pacific, Atlantic, and Indian Oceans.
K.P.D.

N72-26265 Maryland Univ., College Park.
THE DISPERSION OF GRAVITATIONAL RADIATION Ph. D. Thesis
Dennis Chesters 1971 123 p
Avail: Univ. Microfilms Order No. 72-1683

By making calculations analogous to those for the dispersion of radio waves in a collisionless plasma, it was found that short gravitational waves are only slightly dispersed by their interaction with the interstellar medium. In plasma kinetic theory, electromagnetic wave modes are derived from a perturbation expansion of Maxwell's equations, with the currents given by integrals over the charge distribution determined from Boltzmann's equation, where the force term is due to the wave's field. This scheme was adapted to gravitational waves by replacing Maxwell's equations by Einstein's (in the form describing short, weak gravitational waves), and used Boltzmann's equation generalized to include general relativistic effects, where the force term is the perturbed geodesic in the gravitational wave.
Dissert. Abstr.

N72-26266 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
THE OTTAWA PZT OBSERVATIONS, 1956-1970, THEIR COMPARISON WITH BIH VALUES BY GRAPHICAL, SPECTRAL AND FOURIER ANALYSES Publications of the Earth Physics Branch, Volume 42, No. 6
E. G. Woolsey 1972 33 p refs
(M70-42/6) Copyright. Avail: Issuing Activity

Results of measurements of latitude and time made with the Ottawa Photographic Zenith Tube (PZT) from 1956 to 1970 are given. The observations show values of the variation in latitude and longitude with a probable error of .01 sec. They were compared to the published results of the Bureau International de l'Heure. The residuals so formed were subjected to a spectral analysis and it is demonstrated that the PZT was not capable of detecting secular motions of 10 cm or less. No motion was found for Ottawa. The star catalogue is published to contribute to the knowledge of stellar positions. Author

N72-26267*# TRW Systems Group, Redondo Beach, Calif. Space Sciences Dept.
STUDY ON MULTI-SATELLITE, MULTI-MEASUREMENT OF THE STRUCTURE OF THE EARTH'S BOW SHOCK Final Report
10 Mar. 1972 94 p refs
(Contract NASw-2186)
(NASA-CR-127062; TRW-17873-6006-R0-00) Avail: NTIS HC $6.75 CSCL 03B

The pulsation model of the earth's bow shock proposed a nonuniform shock having both perpendicular (abrupt, monotonic) and oblique (oscillatory, multigradient) properties simultaneously, depending on local orientation of the shock surface to the interplanetary field B sub sw in parallel planes defined by B sub sw and solar wind velocity. Multiple, concurrent, satellite observations of the shock and solar wind conditions were used. Twenty-six potentially useful intervals of concurrent Explorer 33 and 35 data acquisition were examined, of which six were selected for closer study. In addition, two years of OGO-5 and HEOS 1 magnetometer data were examined for possible conjunctions to these spacecraft having applicable data. One case of clear nonuniformity and several of field-dependent structure were documented. A computational aid, called pulsation index, was developed. Author

N72-26268*# Texas A&M Univ., College Station. Dept. of Physics.
DEGREE AND PLANE OF POLARIZATION OF MULTIPLE SCATTERED LIGHT. 2: EARTH'S ATMOSPHERE WITH AEROSOLS
Gilbert N. Plass and George W. Kattawar 1 Apr. 1972 38 p refs
(Grant NGR-44-001-117)
(NASA-CR-127044; Rept-4) Avail: NTIS HC $4.00 CSCL 04A

The degree of polarization, as well as the direction of the plane of polarization, were calculated by a Monte Carlo method for the reflected and transmitted photons from the earth's atmosphere. The solar photons were observed during multiple collisions with aerosols and the Rayleigh scattering centers in the atmosphere. The aerosol number density, as well as the ratio of aerosol to Rayleigh scattering, varies with height. The proportion of aerosol to Rayleigh scattering was appropriately chosen at each wavelength 0.4 microns and 0.7 microns; ozone absorption was included where appropriate. Three different aerosol number densities were used to study the effects of aerosol variations. Results are given for a solar zenith angle of 81.37 deg and a surface albedo of zero. The polarization of the reflected and transmitted photons was found to be sensitive to the amount of aerosols in the atmosphere at certain angles of observation. Author

N72-26269*# Woods Hole Oceanographic Institution, Mass. Dept. of Physical Oceanography
ELECTRONIC RESEARCH AND TECHNOLOGY REQUIREMENTS FOR MARINE RESOURCES
Gifford C. Ewing Dec. 1971 33 p refs
(Contract NAS12-631)
(NASA-CR-127073; WHOI-Ref-71-71) Avail: NTIS HC $3.75 CSCL 08C

The Woods Hole air/space oceanographic program for 1969 is discussed. Studies included: (1) monitoring the sharp temperature boundary of the Gulf Stream by microwave and infrared observation, (2) spectrophotometry of the Gulf Stream and the adjacent continental slope and shelf water over Georges Bank, (3) interpretation of cloud and other meteorological data in terms of the effects of wind and sun on the upper ocean, (4) a sea state test plan, (5) systems research, and (6) ocean data recovery by aircraft and satellite. K.P.D.

N72-26270*# Techtran Corp., Glen Burnie, Md.
METHOD AND APPARATUS FOR EXPERIMENTAL DETERMINATION OF HEAT EXCHANGE IN SOIL
D. P. Bespalov Washington NASA Jun. 1972 27 p refs Transl. into ENGLISH from Tr. Glavnaya Geofizicheskaya Observ. (Leningrad), no. 103, 1960 p 68-84
(Contract NASw-2037)
(NASA-TT-F-14329) Avail: NTIS HC $3.50 CSCL 08M

A generalization is presented of experimental and theoretical studies dealing with the development and improvement of methods of determining heat flux in soils. Author

N72-26271*# General Electric Co., Philadelphia, Pa.
A REVIEW OF CARBON MONOXIDE SOURCES, SINKS, AND CONCENTRATIONS IN THE EARTH'S ATMOSPHERE
M. H. Bortner, R. H. Kummler, and L. S. Jaffe Washington NASA Jun. 1972 57 p refs
(Contract NAS1-10139)
(NASA-CR-2081) Avail: NTIS HC $3.00 CSCL 04A

Carbon monoxide is a toxic pollutant which is continually introduced into the earth's atmosphere in significant quantities. There are apparently some mechanisms operating which destroy most of the CO in the atmosphere, i.e., a carbon monoxide sink. These mechanisms have not as yet been established in a quantitative sense. This report discusses the various possible removal mechanisms which warrant serious consideration. Particular emphasis is given to chemical reactions (especially that with OH), soil bacteria and other biological action, and transport effects. The sources of carbon monoxide, both natural and anthropogenic, are reviewed and it is noted that there is quite possibly a significant undefined natural source. Atmospheric CO concentrations are discussed and their implications on carbon monoxide lifetime, sinks and sources are considered. Author

N72-26272*# National Aeronautics and Space Administration, Washington, D.C.
REMOTE SENSING OF THE CHESAPEAKE BAY
1972 176 p refs Conf. held at Wallops Station, Va., 5-7 Apr. 1971 Original Contains Color Illustrations
(NASA-SP-294; LC-74-190299) Avail: NTIS SOD $2.25 CSCL 08J

The proceedings of a conference on remote sensing of the Chesapeake Bay are presented. Primary emphasis was placed on the application of specific remote sensing techniques to determine various aspects of the ecology of the area. Subjects discussed are: (1)environmental pollution from industrial wastes, air pollution, and agricultural sedimentation and wastes, (2) environmental balance as related to estuarine turbidity, flushing, salinity, and circulation, (3) natural resources, (4) recreational uses, and (5) economic activity. For individual titles, see N72-26273 through N72-26285.

N72-26273*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
TECHNICAL KEYNOTE ADDRESS ON REMOTE SENSING
Marvin R. Holter and Arch B. Park *In its* Remote Sensing of the Chesapeake Bay 1972 p 5-47 ref Original Contains Color Illustrations (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 08J

A review of remote sensing techniques is presented. Various types of remote sensors are described and the platforms used to mount the sensors are examined. Examples of remote sensing by aerial photography in infrared, ultraviolet, and visual spectra are included. The types of equipment are designated and their specific areas of application are defined. It is concluded that the primary objective of remote sensing is to contribute to man's ability to manage and use the terrestrial environment. Author

N72-26274*# Johns Hopkins Univ., Baltimore, Md.
INDUSTRIAL WASTE POLLUTION
Loren D. Jensen *In* NASA, Washington Remote Sensing of the Chesapeake Bay 1972 p 49-58 refs (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 08J

The characteristics and effects of industrial waste pollution in the Chesapeake Bay are discussed. The sources of inorganic and organic pollution entering the bay are described. The four types of pollutants are defined as: (1) inorganic chemical wastes, (2) naturally occurring organic wastes, (3) synthetic organic wastes (exotics) and (4) thermal effluents. The ecological behavior of industrial wastes in the surface waters is analyzed with respect to surface film phenomena, interfacial phenomena, and benthis phenomena Author

N72-26275*# Department of Natural Resources and Environmental Control, Dover, Del.
SOME APPLICATIONS OF REMOTE SENSING IN ATMOSPHERIC MONITORING PROGRAMS
Austin N. Heller, John C. Bryson, and N. C. Vasuki *In* NASA, Washington Remote Sensing of the Chesapeake Bay 1972 p 59-71 refs (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 04A

The applications of remote sensing in atmospheric monitoring programs are described. The organization, operations, and functions of an air quality monitoring network at New Castle County, Delaware is discussed. The data obtained by the air quality monitoring network ground stations and the equipment used to obtain atmospheric data are explained. It is concluded that correlation of the information obtained by the network will make it possible to anticipate air pollution problems in the Chesapeake Bay area before a crisis develops. Author

N72-26276*# Virginia Inst. of Marine Science, Gloucester Point.
AGRICULTURAL AND URBAN POLLUTION
Morris L. Brehmer *In* NASA, Washington Remote Sensing of the Chesapeake Bay 1972 p 73-76 (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 04A

The degradation produced by the introduction of agricultural and urban wastes into estuarine systems, with emphasis on the Chesapeake Bay area, is discussed. The subjects presented are: (1) effects of sediment loading and (2) organic and nutrient loading problems. The impact of high turbidity on the biological life of the bay is analyzed. The sources of nutrients which produce over-enrichment of the waters and the subsequent production of phytoplankton are examined. Author

N72-26277*# Johns Hopkins Univ., Baltimore, Md.
ESTUARINE TURBIDITY, FLUSHING, SALINITY, AND CIRCULATION
Donald W. Pritchard *In* NASA, Washington Remote Sensing of the Chesapeake Bay 1972 p 77-82 (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 08J

The effects of estuarine turbidity, flushing, salinity, and circulation on the ecology of the Chesapeake Bay are discussed. The sources of fresh water, the variations in salinity, and the circulation patterns created by temperature and salinity changes are analyzed. The application of remote sensors for long term observation of water temperatures is described. The sources of sediment and the biological effects resulting from increased sediments and siltation are identified. Author

N72-26278*# Maryland Univ., College Park.
REMOTE SENSING AND EXTRACTABLE BIOLOGICAL RESOURCES **c04**
L. Eugene Cronin *In* NASA, Washington Remote Sensing of the Chesapeake Bay 1972 p 83-89 refs (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 08A

The nature and quantity of extractable biological resources available in the Chesapeake Bay are discussed. The application of miniaturized radio sensors to track the movement of fish and birds is described. The specific uses of remote sensors for detecting and mapping areas of algae, red tide, thermal pollution, and vegetation beds are presented. The necessity for obtaining information on the physical, chemical, and meteorological features of the entire bay in order to provide improved resources management is emphasized. Author

N72-26279*# Smithsonian Institution, Washington, D.C.
AGRICULTURE AND FORESTRY: IDENTIFICATION, VIGOR, AND DISEASE
Dale W. Jenkins *In* NASA, Washington Remote Sensing of the Chesapeake Bay 1972 p 91-102 (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 02F

The agricultural and forestry areas which comprise the watershed of the Chesapeake Bay are described. Major problems of watershed creation and management with emphasis on the erosion problem are discussed. Remote sensing as it relates to the identification of plant species and vigor, pollution, disease, and insect infestation are examined. The application of infrared photography, multispectral sensing, and sequential survey is recommended to identify ecological changes and improve resources management. Author

N72-26280*# Commission of Outdoor Recreation, Richmond, Va.
RECREATIONAL USES
Elbert Cox *In* NASA, Washington Remote Sensing of the Chesapeake Bay 1972 p 103 (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 08J

The application of remote sensors for management planning of recreational areas in and around the Chesapeake Bay is discussed. The use of infrared photography to examine topography, ground water conditions, biotic life, access to surface water, and surrounding land use is emphasized. It is concluded that the greatest advantage to be obtained from remote sensors is the speed with which the data can be acquired and interpreted to permit timely conservation measures to be taken. Author

N72-26281*# Virginia Inst. of Marine Science, Gloucester Point.
ENGINEERING WORKS AND THE TIDAL CHESAPEAKE
William J. Hargis, Jr. *In* NASA, Washington Remote Sensing of the Chesapeake Bay 1972 p 105-123 refs (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 08J

The tidal tributaries of the ocean and coastal areas of the mid-Atlantic region and the ecological significance of engineering projects are discussed. The effects of engineering works on maritime environments and resources, with the Chesapeake Bay as the area of prime interest are examined. Significant engineering projects, both actual and proposed, are described. The conflict of navigational demands and maintenance of an estuarine environment for commercial and sport fishing and recreation is described. Specific applications of remote sensors for analyzing ecological conditions of the bay are included. Author

N72-26282*# Maryland Dept. of Chesapeake Bay Affairs, Annapolis.
USE OF REMOTE SENSING IN SHORELINE AND NEAR SHORE MANAGEMENT
John R. Capper *In* NASA, Washington Remote Sensing of the Chesapeake Bay 1972 p 125-127 (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 08J

The legal aspects of resources management to regulate near-shore and shoreline area activities in the Chesapeake Bay are discussed. The need for information and acquisition in order to define the resources prior to developing legislation on resources management is explained. The steps which are followed in devising the regulatory legislation and enforcing its provisions are outlined. Author

N72-26283*# Geological Survey, Washington, D.C.
PROBLEMS OF URBAN DEVELOPMENT AND GROWTH
Arch C. Gerlach and James R. Wray *In* NASA, Washington Remote Sensing of the Chesapeake Bay 1972 p 129-138 Original Contains Color Illustrations (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 13B

The increase in the density of human population in urban areas and the effects on various aspects of the environment are discussed. The application of remote sensors to measure, analyze, and predict urban changes and their environmental impact is described. Examples of urban area mapping by aerial photography are included. The methods which have been developed to acquire, analyze, utilize, and preserve remotely sensed data on urban development are presented. Author

N72-26284*# Corps of Engineers, Baltimore, Md.
CHESAPEAKE BAY STUDY
William J. Love *In* NASA, Washington Remote Sensing of the Chesapeake Bay 1972 p 139-142 (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 08J

The objectives and scope of the Chesapeake Bay study are discussed. The physical, chemical, biological, political, and social phenomena of concern to the Chesapeake Bay area are included in the study. The construction of a model of the bay which will provide a means of accurately studying the interaction of the ecological factors is described. The application of the study by management organizations for development, enhancement, conservation, preservation, and restoration of the resources is examined. Author

N72-26285*# Johns Hopkins Univ., Baltimore, Md.
SUMMARIES OF GROUP DISCUSSIONS
Loren D. Jensen *In* NASA, Washington Remote Sensing of the Chesapeake Bay 1972 p 143-144 (See N72-26272 17-13)
Avail: NTIS; SOD $2.25 CSCL 13B

Group discussions following the presentations of reports on the remote sensing of Chesapeake Bay resources are presented. The parameters to be investigated by the remote sensors and the specifications of the sensors are described. Specific sensors for obtaining data on various aspects of the ecology are identified. Recommendations for establishing a data bank and additional efforts to obtain increased understanding of the ecology are submitted. P.N.F.

N72-26286*# Translation Consultants, Ltd., Arlington, Va.
PHYSICAL PROPERTIES OF ROCKS AT HIGH TEMPERATURE

A. P. Dmitriyev, L. S. Kuzyayev, Yu. I. Protasov, and V. S. Yamshchikov Washington NASA Jun. 1972 200 p refs
Transl. into ENGLISH of the publ. "Fizicheskiye Svoystva Gornykh Porod pri Vysokikh Temperaturakh" Moscow, Nedra Press, 1969
(Contract NASw-2038)
(NASA-TT-F-684) Avail: NTIS HC $3.00 CSCL 08G

The results are presented of theoretical and experimental studies of the strength, elastic, acoustics, thermal, and electromagnetic properties of rocks as a function of temperature. A detailed description of methods for investigating the physical properties of rocks at high temperatures and examples of the use of the dependence of physical properties of rocks on temperature for solving mining problems are included. The book is intended for scientific workers, engineers and technicians engaged in the mining and processing of minerals and may also be useful to college students concerned with problems in the geology, mineralogy, chemistry and physics of rocks, and the methods and equipment employed in extracting and processing minerals.
Author

N72-26287# Institut d'Aeronomie Spatiale de Belgique, Brussels.
THE PRODUCTION OF NITRIC OXIDE IN THE STRATOSPHERE BY OXIDATIONS OF NITROUS OXIDE
M. Nicolet and W. Peetermans 1972 38 p refs
(Rept-101) Avail: NTIS HC $4.00

The reaction of the electronically excited oxygen atom O(1D) with nitrous oxide, suggested as a natural source of nitric oxide in the stratosphere, may lead to a production of the order of (1 + or - 0.5) X 10 to the 8th power NO molecules/sq cm sec. The predictability of a reliable estimate of the NO production in the stratosphere depends on the exact determination of the variable flux from the troposphere of N2O molecules (of the order of (1 + or - 0.5) X 10 to the 9th power molecules/sq cm sec). In situ sources of stratospheric N2O seem to be negligible and the introduction of nitrogen oxides by upward transport from the troposphere and of nitric oxide by downward transport from the mesosphere requires adequate conditions at the tropopause and stratopause. An assumed operation of 500 SST aircraft in the stratosphere would lead to an artificial emission of nitric oxide molecules of the same order of magnitude as the natural production from nitrous oxide.
Author

N72-26288*# Mississippi State Univ., State College. Inst. of Environmental Sciences.
THE GEOMETRY AND PHYSICAL PROPERTIES OF EXHAUST CLOUDS GENERATED DURING THE STATIC FIRING OF S-1C AND S-2 ROCKET ENGINES
Richard E. Forbes, Michael R. Smith, and Ralph R. Farrell Washington NASA Jun. 1972 106 p refs
(Grant NGL-25-001-32)
(NASA-CR-2049; IES-7-10-2) Avail: NTIS HC $3.00 CSCL 04A

An experimental program was conducted during the static firing of the S-1C stage 13, 14, and 15 rocket engines and the S-2 stage 13, 14, and 15 rocket engines. The data compiled during the experimental program consisted of photographic recordings of the time-dependent growth and diffusion of the exhaust clouds, the collection of meteorological data in the ambient atmosphere, and the acquisition of data on the physical structure of the exhaust clouds which were obtained by flying instrumented aircraft through the clouds. A new technique was developed to verify the previous measurements of evaporation and entrainment of blast deflector cooling water into the cloud. The results of the experimental program indicate that at the lower altitudes the rocket exhaust cloud or plume closely resembles a free-jet type of flow. At the upper altitudes, where the cloud is approaching an equilibrium condition, structure is very similar to a natural cumulus cloud.
Author

N72-26289*# Mississippi State Univ., State College. Inst. for Environmental Studies.
A DIRECT NUMERICAL METHOD FOR PREDICTING CONCENTRATION PROFILES IN A TURBULENT BOUNDARY LAYER OVER A FLAT PLATE M.S. Thesis
James W. Dow Washington NASA Jun. 1972 116 p refs
(Grant NGL-25-001-32)
(NASA-CR-2050; IES-72-02-001) Avail: NTIS HC $3.00 CSCL 06F

A numerical solution of the turbulent mass transport equation utilizing the concept of eddy diffusivity is presented as an efficient method of investigating turbulent mass transport in boundary layer type flows. A FORTRAN computer program is used to study the two-dimensional diffusion of ammonia, from a line source on the surface, into a turbulent boundary layer over a flat plate. The results of the numerical solution are compared with experimental data to verify the results of the solution. Several other solutions to diffusion problems are presented to illustrate the versatility of the computer program and to provide some insight into the problem of mass diffusion as a whole.
Author

N72-26290*# Geological Survey, Washington, D.C.
HYDROLOGIC INTERPRETATIONS BASED ON INFRARED IMAGERY OF LONG ISLAND, NEW YORK
Edward J. Pluhowski 1972 24 p refs Sponsored by NASA
(NASA-CR-127032; USGS-WSP-2009-B; LC-75-190389) Avail: NTIS; SOD $0.30 CSCL 08C

Six remote-sensing flights over Long Island's north and south shores were made during the period July 13, 1967, to February 25, 1970. Infrared imagery in the 8- to 14-micrometer range was obtained; results varied from poor to excellent in quality. The ability of the RS 7 and Reconofax 4 imagers to discern thermal contrasts of as little as 1 to 2 C (Celsius) permitted identification of areas of heavy ground-water discharge. These areas were concentrated primarily along the eroded headlands of the north shore and in the lower reaches of watercourses draining into Great South Bay. Only a few highly localized examples of direct ground-water discharge into the embayments along Long Island's south shore were detected in the imagery. Thermal loading emanating from a powerplant near Oceanside is shown to be quickly dissipated in Middle Bay. Optimal time for the collection of infrared imagery for hydrologic studies on Long Island is in summer and in winter, when surface-water thermal differences are relatively large.
Author

N72-26291# National Weather Service, Silver Spring, Md. Systems Development Office.
SPLASH (SPECIAL PROGRAM TO LIST AMPLITUDES OF SURGES FROM HURRICANES). 1: LANDFALL STORMS
Chester P. Jelesnianski Apr. 1972 56 p
(NOAA-TM-NWS-TDL-46) Avail: NTIS HC $5.00

Two separate methods (based on dynamics) to estimate or forecast the surge of a tropical storm are developed. The first method, in which precomputed nomograms are used, is designed only to arrive at a peak surge value. Arguments for the nomograms are simple meteorological parameters. In the second method, a dynamic model is used to compute surges along an entire coastline. Computations are done by computer, and surface meteorological parameters are used as input to the operational program. Qualitative explanations for the surge phenomena are presented. The relative importance of various meteorological parameters, continental shelf topography, and coastal geography are discussed.
Author

N72-26292# Council on Environmental Quality, Washington, D.C.
THE QUIET REVOLUTION IN LAND USE CONTROL Summary Report
Fred Bosselman and David Callies 15 Dec. 1971 38 p
Avail: SOD $0.45

A summary is presented of a report commissioned by the Council on Environmental Quality analyzing the innovative land use laws of several states in order to learn how some of the most complex land use issues are being addressed. This report is of interest because the proposed National Land Use Policy Act

(S. 992, H.R. 4332) would provide federal assistance to states to develop programs dealing with land use issues of regional or state concern. Author

N72-26293*# Scientific Translation Service, Santa Barbara, Calif.

MOVEMENT OF SOIL MOISTURE UNDER TEMPERATURE GRADIENTS

Y. Suzuki Washington NASA Jun. 1972 20 p refs Transl. into ENGLISH from Nogyo Kisho (Tokyo), v. 18, no. 3, Dec. 1962 p 98-104
(Contract NASw-2035)
(NASA-TT-F-14291) Avail: NTIS HC $3.00 CSCL 08M

The effect of a temperature gradient on the movement and distribution of soil moisture has been examined in closed column of soil for various initial water contents (1%to 7%). The results are as follows: (1) In all except the dryest and wettest columns of soil there was a transfer of moisture towards the colder end from the warmer, that is, water evaporating from the hotter soil moves as vapor into colder soil, where it condenses and returns as liquid when a favorable gradient of moisture has been established. (2) For the transfer of soil moisture, liquid flow works as a control factor and reduces the amount of net transfer due to temperature gradient. (3) The amount of transfer of soil moisture varies with the initial water content, and for sand (particle size 0.175 to 0.5 mm) the maximum transfer of moisture from the hot to the cold end occurred at between 3.5% and 4.0% of the initial water content which is approximately one third of the moisture equivalent. (4) The observed net transfer of moisture coincides with the vapor flows calculated by the diffusion equation of Penman, Krischer and Rohnalter, et al. quite well at the maximum transfer of moisture, but not in other ranges of initial water content. Author

N72-26294# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).

SATELLITE BEACON OBSERVATIONS FROM 1964 TO 1970

G. K. Hartmann, K. Oberlaender, G. Schmidt, and J. P. Schoedel 1972 94 p refs
Avail: NTIS HC $6.75

From October 1964 to May 1969 the 40 MHz, 41 MHz, and 360 MHz signals of the satellite Explorer 22, were recorded at Lindau (51,650 deg N; 10,125 deg E). The Faraday effect recordings at 40 MHz and 41 MHz and dispersive Doppler effect recordings at 40 MHz and 360 MHz were used to calculate the ionospheric electron content up to 1000 km. The mean electron content for 1 hour periods over a period of three months as obtained at 51.6 deg N geographic latitude as derived from various evaluation methods is presented. Furthermore, the relevant critical frequency FOF2 is displayed. A similar presentation was chosen for the calculated slab thickness data. For one specific case the daily variation of the electron content as determined by measurements was compared with a relevant theoretical curve. The agreement was fairly good. Due to technical problems the beacons were switched off in 1969. Author

N72-26295# National Physical Lab., New Delhi (India). Radio Science Div.

IONOSPHERIC DATA, NOVEMBER 1970

Nov. 1970 80 p refs
(RTRC-A186) Avail: NTIS HC $6.00

Tables of hourly values of propagation data for the E and F regions are presented for several stations in India. These include critical frequency, minimum virtual height, F-min, and M(3000)F2 data. Author

N72-26296*# Translation Consultants, Ltd., Arlington, Va.

ESTIMATING THE ACCURACY OF A SIMPLE METHOD FOR CALCULATING THE HEAT BALANCE IN THE SOIL

A. G. Broydo and N. A. Suboch Washington NASA Jun. 1972 11 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Obs. (Leningrad), no. 69, 1957 p 94-99
(Contract NASw-2038)
(NASA-TT-F-14334) Avail: NTIS HC $3.00 CSCL 08M

The different methods used to measure the heat held in the upper layers of the soil, or given up by those layers, over a particular time span are discussed and their accuracy evaluated. Author

N72-26297*# Translation Consultants, Ltd., Arlington, Va.

EOLE: COMPLEMENTING EXPERIMENTS

Washington NASA Jun. 1972 5 p Transl. into ENGLISH of "EOLE: Experiences Complementaires", Press Release CNES-117, CNES, Bretigny, France, 23 May 1972 4 p
(Contract NASw-2038)
(NASA-TT-F-14350; CNES-117) Avail: NTIS HC $3.00 CSCL 08A

Supplementary experiments with the EOLE satellite are described, comprising data acquisition and tracking, using messages transmitted from ships and drifting buoys. Author

N72-26298# Department of Agriculture, Washington, D.C. Economic Research Service.

THE LOOK OF OUR LAND. AN AIRPHOTO ATLAS OF THE RURAL UNITED STATES: THE PLAINS AND PRAIRIES

Simon Baker, comp. and Henry W. Dill, Jr., comp. Oct. 1971 84 p
(USDA-HB-419) Avail: SOD $1.00

An atlas is presented which brings together the text of Agriculture Handbook 296 with photos to show land use and related information according to an established regional and area classification of U.S. land resources. The airphotos were selected to show characteristics and land use in 36 resource areas in 11 States in the area along the 100th meridian. Accompanying the photos of each area is a brief description of land use, climate, soils, and topography for that area. Land uses are usually described verbally or quantitatively, or are depicted on maps. Author

N72-26299*# Grambling Coll., La. Dept. of Physics.

FREQUENCY DEPENDENCE OF ATS-1 OBSERVED MICROPULSATIONS OF SOME GEOPHYSICAL PARAMETERS

Freddie Mason, W. D. Cummings, and P. J. Coleman, Jr. May 1972 10 p Revised Prepared in cooperation with Calif. Univ., Los Angeles
(Grants NGR-19-011-007; NGL-05-007-004)
(NASA-CR-127040) Avail: NTIS HC $3.00 CSCL 03C

Low frequency oscillations in the earth's magnetic field at the synchronous orbit were observed with the magnetometer experiment on board the ATS 1 satellite since Dec. 1966. An analysis of oscillations in the range $.002 < f < .02$ H3 for the interval Dec. 1966 through Dec. 1968 is reported. It was found that the frequency of an event increases with the sum of Kp for 24 hours prior to the event midpoint. For events with duration greater than 6 hours, the product moment correlation coefficient for frequency f, and the sum Kp was $R = 0.87$. The best least squares linear fit to the data for these events was $f = (0.32)$ sum $Kp = 5.1$. For the same events the correlation coefficient for frequency and Dst was $R = -0.83$. Author

N72-26300*# Grambling Coll., La. Dept. of Physics.

SPECTRAL AND POLARIZATION ANALYSIS OF MICROPULSATIONS OBSERVED AT ATS-1

William Morris, W. D. Cummings, and R. L. McPherron May 1972 11 p Revised Prepared in cooperation with Calif. Univ., Los Angeles
(Grants NGR-19-011-007; NGL-05-007-004)
(NASA-CR-127041) Avail: NTIS HC $3.00 CSCL 03C

Results are reported for an analysis of low frequency oscillations in the earth's magnetic field as observed at the synchronous orbit by the magnetometer experiment on board

ATS 1. Oscillations in the range $.002 < f < .02$ H3 for the period Dec. 1966 through Dec. 1967 were studied. The analysis combines a detailed, computer-processed, spectral analysis of selected events with a less detailed manual analysis of all events in the two year time interval from Dec. 1966 to Dec. 1968. The computer analysis revealed that a given event is often characterized by a dominant, narrow, spectral peak whose associated oscillations are almost entirely limited to a plane, together with several minor peaks. Dynamic spectral analyses revealed that minor spectral peaks appear as short isolated bursts. The sense of rotation of the perturbation vector tends to change from right-handed elliptical at the beginning of a burst to left-handed elliptical at the end. The major axis of the polarization ellipse is inclined by typically 30 deg east of radial. Author

N72-26301# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF LONG-RANGE TROPOSPHERIC PROPAGATION OF CENTIMETER AND DECIMETER WAVES OVER THE LENINGRAD-PETROZAVODSK ROUTE
V. N. Troitskiy 13 Jun. 1972 13 p ref Transl. into ENGLISH from Radiotekhnika (Moscow), v. 27, no. 3, 1972 p 29-35
Avail: NTIS HC $3.00

An investigation of long range tropospheric propagation of 30 and 6.7 cm waves was conducted on the Leningrad-Petrozavodsk route in the period 1968 to 1969. The determination of the relationship between the attenuation multiplier and the frequency was studied. It was shown that the relationship in the case of antennas with equal gain varies strongly with the season of the year. Author

N72-26302*# Massachusetts Inst. of Tech., Cambridge.
GRAVITATION RESEARCH Quarterly Report
R. Weiss, D. J. Muehlner, R. L. Benford, D. K. Owens, N. A. Pierre, and M. Rosenbluh 15 Apr. 1972 63 p refs
(Grant NGR-22-009-526; Contract DAAB07-71-C-0300; Grant NSF GP-24254)
(NASA-CR-127066; QPR-105) Avail: NTIS HC $5.25 CSCL 03B

Balloon measurements were made of the far infrared background radiation. The radiometer used and its calibration are discussed. An electromagnetically coupled broadband gravitational antenna is also considered. The proposed antenna design and noise sources in the antenna are reviewed. A comparison is made between interferometric broadband and resonant bar antennas for the detection of gravitational wave pulses. K.P.D.

N72-26303# Lockheed Missiles and Space Co., Palo Alto, Calif.
STUDY OF THE TERRAIN TOPOGRAPHY BY MEANS OF THE LUNOKHOD-1 MOTION TRACK
B. N. Rodionov, B. V. Nepoklonov, and V. V. Kiselev 1971 14 p refs Transl. into ENGLISH from the book "Peredvizhenaia laboratoriia na Lune Lunokhod-1" Akad. Nauk SSSR Press, Moscow, 1971 p 65-73
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A topographical survey of the lunar surface using the motion track of Lunokhod-1 was made. Experiments cover attempts to: (1) obtain representations of the geometric structure of the lunar surface and the principles for a statistical estimate of the terrain saturation by any kinds of formation, (2) determine the size, shape, and disposition of such terrain, (3) determine the coordinates of points of chemical composition and the physical characteristics of the lunar soil, (4) select direction of safe motion and (5) estimate the accuracy of navigating the self-propelled vehicle. E.H.W.

N72-26304# Lockheed Missiles and Space Co., Palo Alto, Calif.
COMPOSITION OF RADIATION RECORDED BELOW THE RADIATION BELT DOMAIN IN THE MIDDLE LATITUDES
V. S. Tsaplin, P. I. Shavrin, and O. I. Savun 1972 4 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 12, no. 2, 1972 p 177-179
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

On the basis of data obtained from measurements on the Cosmos 137 and Cosmos 143 satellites, a deduction was made concerning the composition of excess radiation (relative to the primary cosmic ray background) which was recorded in space. The parameters which characterize this region of space are given. Author

N72-26305*# Scientific Translation Service, Santa Barbara, Calif.
THE INFLUENCE OF TEMPERATURE ON THE DIRECTION OF WATER MOVEMENT IN THE SOIL
H. Roseau Washington NASA Jul. 1972 9 p Transl. into ENGLISH from "Sens du Mouvement de l'Eau dans le Sol l'Infuence de la Temperature", Centre Natl. de la Rech. Sci., France; Colloques Internationaux, no. 35, 1953 p 347-352
(Contract NASw-2035)
(NASA-TT-F-14325) Avail: NTIS HC $3.00 CSCL 08M

Results of observations, utilizing lysimetric boxes set at the end of the flow, on the variations of drainage with temperature are reported. Observing that the volume of runoff passing (per unit time) at the bottom of the box varies in the same way as the temperature of the surface soil layer, an explicative theory of this phenomenon is proposed. Author

N72-26306*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE DETERMINATION OF THE LONG PERIOD TIDAL PERTURBATIONS IN THE ELEMENTS OF ARTIFICIAL EARTH SATELLITES
Peter Musen and Theodore Felsentreger May 1972 50 p refs
(NASA-TM-X-65916; X-550-72-192) Avail: NTIS HC $4.50 CSCL 08C

The magnitude of the tidal effects depends upon the elastic properties of the earth as described by Love numbers. The Love numbers appear as the coefficients in the expansion of the exterior tidal potential in terms of spherical harmonics (in Maxwellian form). A single averaging process was performed only along the parallels of latitude. This process preserves additional long period tidal effects (with periods of a few days or more). It also eliminates the short period effects with periods of one day or less. Author

N72-26307*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE TRIGGERING OF POLAR MAGNETIC SUBSTORMS BY SUDDEN STORM COMMENCEMENTS
J. L. Burch Jun. 1972 13 p refs Submitted for publication
(NASA-TM-X-65915; X-646-72-191) Avail: NTIS HC $3.00 CSCL 04A

Possible relationships are examined between the latitude of a discontinuity in the interplanetary magnetic field for a period prior to sudden storm commencements and the probability of sudden storm commencement-triggered negative bays. Author

N72-26308*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISTRIBUTIONS AND CHARACTERISTICS OF HIGH-LATITUDE FIELD ALIGNED ELECTRON PRECIPITATION
F. W. Berko Jun. 1972 37 p refs Submitted for publication
(NASA-TM-X-65914; X-646-72-190) Avail: NTIS HC $4.00 CSCL 04A

Satellite measurements of field-aligned auroral electron precipitation were analyzed using 16 months of data from the OGO-4 auroral particles experiment. It was observed that the anisotropies are of short time duration and are most likely to occur when particle fluxes are high. Field-aligned 2.3 keV electron precipitation is found in an oval shaped region primarily in the nighttime hours, with a maximum probability at approximately 70 deg invariant latitude near midnight, congruent to and poleward of the auroral optical emissions in these hours.

This precipitation was found to be associated with the high latitude boundary of auroral electron precipitation during substorm expansion and is characterized by a harder and more intense energy spectrum than typical isotropic precipitation.
Author

N72-26309*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ATLAS OF LOW LATITUDE 6300A (01) NIGHT AIRGLOW FROM OGO-4 OBSERVATIONS
Edith I. Reed, Walter B. Fowler (Centre Natl. de Rech. Sci., Verrieres leBuisson, France), and Jacques E. Blamont May 1972 52 p refs Submitted for publication
(NASA-TM-X-65913; X-625-72-171) Avail: NTIS HC $4.75 CSCL 04A

The atomic oxygen emission line at 6300 A, measured in the nadir direction by a photometer on the polar orbiting satellite OGO-4, was plotted between 40 deg N and 40 deg S latitude on a series of maps for the moon-free periods between 30 August 1967 and 10 January 1968. The longitudinal and local time variations which occur during the northern fall-winter season are indicated. The northern tropical arc is more widespread while the southern arc is not present at all longitudes. The conditions under which the observations were made are described, and four airglow maps were selected to show the local time variations.
Author

N72-26310*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IONOSPHERE TOTAL ELECTRON MEASUREMENTS AS EXTRACTED FROM SATELLITE TRACKING DATA
Charles W. Murray, Jr. , P. E. Schmid (NAS/NRC, Washington, D. C.), and S. Rangaswamy 21 Jun. 1972 19 p refs
(NASA-TM-X-65911; X-551-71-475) Avail: NTIS HC $3.00 CSCL 04A

The Goddard Range and Range Rate System (GRARR) determines the range of a spacecraft by measuring the group delay of a modulated wave and the range rate by measuring the Doppler phase shift of the carrier. An analytical technique is presented for obtaining corrections and equivalent total electron content along the vertical, using VHF GRARR data and a radial model of the ionosphere. The results of computation for a representative pass are given, and estimated accuracy is discussed from a statistical view point. Using VHF GRARR data and a radial model of the ionosphere. The results of computation for a representative pass are given, and estimated accuracy is discussed from a statistical view point. Using GRARR range, range rate, and angle tracking data from Explorer 41, values of total electron content on the order of 10 to the 17th to 10 to the 18th power (electrons/sq m) were obtained. These values agree with estimates of the total electron content from ionospheric profiles using f sub o F sub 2 predict data.
Author

N72-26311# Woods Hole Oceanographic Institution, Mass.
BIBLIOGRAPHY OF TECHNICAL REPORTS, 1971
Cecelia B. Fuglister, comp. Jan. 1972 11 p refs
(WHOI-71-78) Avail: NTIS HC $3.00

A bibliography of oceanographic technical reports is presented on topics which include underwater acoustics, gravity and seismic surveys, geology and geophysics, ocean circulation, organic and inorganic chemical analyses, statistical methods, instrumentation, hydrography, air water interactions, remote sensing, and paleotectonics.
K.P.D.

N72-26312# Sandia Labs., Albuquerque, N.Mex.
LIGHTNING AND BALL LIGHTNING: FRONTIERS FOR RESEARCH
J. A. Cooper [1971] 38 p refs Presented at the Elec. Eng. and Computer Sci. Conf. Albuquerque, 18 May 1971
(SC-R-722645) Avail: NTIS

Lightning and ball lightning information about events affects areas including electrothermochemistry, magnetohydrodynamics, meteorology, safety engineering, and weapons strategy. Studies of lighting and ball lightning are made difficult by relative inaccessibility to experimentalists. However, there is a strong possibility that triggering mechanisms might be employed in studying these phenomena.
Author

N72-26313# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
TIME-DEPENDENT YUKAWA POTENTIALS OF A CLASS OF WEAK GRAVITATIONAL FIELDS
I. P. Nedelkov 1972 8 p refs
(JINR-E2-6216) Avail: AEC Depository Libraries

The central symmetric solutions of a class of generalized gravitational equations are obtained. The computations are made in the Newtonian limit. The solutions contain terms both of Newtonian and Yukawa type. The latter are time dependent.
Author (NSA)

N72-26314# European Space Research Inst., Frascati (Italy).
A SELF-CONSISTENT TWO-DIMENSIONAL APPROACH TO MAGNETOSPHERIC STRUCTURES
M. Soop and K. Schindler 1972 39 p refs Submitted for publication
Avail: NTIS HC $4.00

A simple self-consistent description of the geomagnetic tail is given and its consequences are explored. The model is two-dimensional, ignoring the spatial variation along the direction of the tail current. A discussion of equilibria is based on the assumption of an isotropic pressure. One of the conclusions is that the transition between the dipolar and the tail region will take place over a fairly short distance. The analytical results are supplemented by a numerical example. Properties of configurations containing field line loops are investigated. A stability discussion includes the effect of the net magnetic flux through the neutral sheet. The results have consequences for current magnetospheric problems.
Author (ESRO)

N72-26315# Stockholm Univ. (Sweden).
MICROWAVE RADIOMETRY AND ITS POTENTIAL APPLICATION TO EARTH RESOURCES SURVEYS. PART 2: IDENTIFICATION, DESCRIPTION AND JUSTIFICATION OF APPLICATIONS
Gunnar Hoppe, Malin Falkenmark (Intern. Hydrol. Decade), Ulf Karstroem (Meteorol. and Hydrol. Inst.), Harald Svensson (Lund Univ., Swed.) and D. S. Parasnis (Uppsala Univ.) Linkoeping SAAB-Scania Feb. 1972 105 p refs
(Contract ESTEC-1411-71-EL)
(RAC-0-3-R17; ESRO-CR(P)-75) Avail: NTIS HC $7.25

Microwave radiometry is applied to the fields of agriculture (soils, vegetation, and forests), geography (physical and human), hydrology, oceanography, and geology. It is concluded that microwave radiometry has a great potential value for the application fields and that substantial efforts are justified to promote activities both in the study of different applications and regarding technological development. General recommendations are also given.
Author (ESRO)

N72-26316# Danish Meteorological Inst., Charlottenlund.
THULE GEOPHYSICAL OBSERVATORY: MAGNETIC RESULTS, 1965
E. Ulander and J. Wilhjelm Jun. 1971 59 p refs
Avail: NTIS HC $5.00

Tables of hourly and daily means of the magnetic declination and the horizontal and vertical components of the magnetic intensity recorded at Thule, Greenland, in 1965, are presented, along with daily ranges, K and C indices and variometer baseline values.
Author (ESRO)

N72-26317# Helsinki Univ. (Finland). Radio Lab.
SPACE ACTIVITIES IN FINLAND IN 1971
Martti Tiuri, ed. and Seppo Urpo, ed. Apr. 1972 12 p refs

(Rept-S-50) Avail: NTIS HC $3.00

Space research activities in Finland during 1972 are summarized. Among those covered are APT, ionospheric and magnetospheric research, satellite tracking and geodesy, and aspects of international cooperation. Author (ESRO)

N72-26318# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Oct. 1971 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, OCTOBRE 1971]
Oct. 1971 31 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes, Belgium are tabulated for October 1971. Author (ESRO)

N72-26319# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Sep. 1971 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, SEPTEMBRE 1971]
Sep. 1971 31 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes, Belgium are tabulated for September 1971. ESRO

N72-26320# Genoa Univ. (Italy). Ist. Geofisico e Geodetico.
ROBURENT (CUNEO) OBSERVATORY: MAGNETIC BULLETIN, JANUARY - DECEMBER 1971
1972 41 p Sponsored in part by CNR
Avail: NTIS HC $4.25

Geomagnetic field direction and intensity were recorded hourly during 1971 using La Cour-type variometers. Data tables are given. Author (ESRO)

N72-26321# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
THE TRAPPED RADIATION HANDBOOK, JANUARY 1968 - JUNE 1970
John B. Cladis, ed., Gerald T. Davidson, ed., and Lester L. Newkirk, ed. Santa Barbara, Calif. GE Dec. 1971 732 p refs
Prepared for Defense Nucl. Agency
(Contract DA-49-146-XZ-570; Proj. DNA-NWER-XAXH)
(AD-738841; LMSC-6-95-95-3; DNA-2524H) Avail: NTIS CSCL 04/1

The Trapped Radiation Handbook provides useful information and design data for scientists and engineers engaged in the design of spacecraft systems that must operate in the trapped radiation environment. These subjects are discussed: The Magnetosphere; Features and Mathematical Models of the Earth's Magnetic Field; The Motion of Charged Particles in the Field; The Properties of the Particles in the Natural Radiation Belts; Source and Loss Mechanisms; The Artificial Radiation Belts that have resulted from tests of nuclear devices conducted at high altitutes; The Phenomenology of Nuclear Detonations and Beta Injection Processes; The Effects of Trapped Particles--Both Natural and Fission Betas--on Materials and Devices; The Irradiation of Circular Orbit Satellites by Trapped Particles of (1) the natural environment, (2) environments produced by weapon tests at various L-values, and (3) an estimated wartime environment; The Synchrotron Radiation Emitted by the Trapped Electrons; and the Vulnerability of Operational Systems in the Environments (1), (2), and (3) mentioned previously. Author (GRA)

N72-26322# Environmental Technical Applications Center (Air Force), Washington, D.C.
A SELECTED ANNOTATED BIBLIOGRAPHY ON THE TROPOPAUSE
Larry N. Huff Feb. 1972 38 p refs
(AD-738594; USAFETAC-TN-72-4) Avail: NTIS CSCL 04/1

This selected bibliography of references concerning the tropopause contains over 100 items. All entries are annotated by a brief abstract. The language in which the reference is available is noted along with a library reference or source for each of the articles. Articles published during the period 1956-1971 are included. Author (GRA)

N72-26323# Naval Postgraduate School, Monterey, Calif.
SOUND DISPERSION AND PHASE FLUCTUATIONS IN THE UPPER OCEAN M.S. Thesis
Juegen Rautmann 1 Feb. 1972 90 p refs
(AD-738913; NPS-61MD72022A) Avail: NTIS CSCL 08/10

In-Situ measurements of the speed of sound in the upper ocean have revealed the existence of significant dispersion and large fluctuations over the frequency range 25-80 kHz. The near-surface values of c ranged from -6 M/sec to -3 M/sec relative to the bubble-free value, with a maximum estimated error of 0.5 M/sec. It was possible to identify bubbles of 'surface' radius centered around 54 microns down to 4.3 meter depth as well as a population centered around 124 microns (at 4.3 M) found at all depths. The speed fluctuation showed near-Gaussian probability density functions except at the dispersion center frequencies. The standard deviation of the speed varied from 0.27 M/sec for 58.0 kHz to 0.52 M/sec at 69.6 kHz. Author (GRA)

N72-26324# Naval Postgraduate School, Monterey, Calif.
BUBBLE DISTRIBUTIONS IN UPPER OCEAN M.S. Thesis
Frank Hilty Hiestand Dec. 1971 67 p refs
(AD-738968) Avail: NTIS CSCL 08/10

A bubble transport equation has been developed that the bubble distribution, as a function of position, velocity, and size, must satisfy. An analytical model for bubble transport in the upper ocean is chosen and solutions are developed for this model. For a surface source only, these solutions compare favorably to experimental data in the near-surface regions. The depth of this region of agreement depends upon the circulation field chosen, but is of the order of 3 meters. Author (GRA)

N72-26325# Naval Undersea Research and Development Center, San Diego, Calif.
TRANSPARENT HULL SUBMERSIBLES AND THE MAKAKAI
Howard R. Talkington and Douglas W. Murphy Feb. 1972 27 p refs
(AD-738922; NUC-TP-283) Avail: NTIS CSCL 13/10

The transparent hull submersible (THS), MAKAKAI (Hawaiian for 'Eye of the Sea'), can carry two men within its transparent acrylic hull to depths of 183 m. All-around visibility and a very high strength-to-weight ratio are special features of its design. The objectives of the development program, the design constraints, the ordinary technical problems encountered, and the innovations made during the submersible's development are described. Included among the innovations are specialized designs in materials, structures, data processing, propulsion control, and life-support equipment. The uses of the craft and the experience gained during the early at-sea operations are also discussed, and photographs of the undersea operations are included. GRA

N72-26326# Hawaii Inst. of Geophysics, Honolulu.
OCEANOGRAPHIC OBSERVATIONS FOR ACOUSTICAL DETERMINATION IN THE PACIFIC OCEAN NORTH OF HAWAII, MAY - OCTOBER 1969 Interim Technical Report, May - Oct. 1969
Richard C. Latham, Romondt Budd, and Robert G. Zachariadis Aug. 1971 103 p refs
(Contract N00014-67-A-0387-0004)
(AD-738431; HIG-71-11; ITR-3) Avail: NTIS CSCL 08/10

A previous report described a one-year environmental study made between May 1968 and April 1969. This report describes the work accomplished from May 1969 through October 1969. The results of five ship cruises are reported which confirm the variability of the near-surface ocean environment in the area. A definite temperature inversion in the deep ocean below about 3800m depth is described. Several bathymetric profiles are presented; the results of current observations near the Sea Spider site are reported; and the results from analysis of three cores taken by USNS SANDS at the Sea Spider site are reported. Author (GRA)

N72-26327# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.

THE INTERACTION OF LARGE AMPLITUDE SHALLOW WATER WAVES WITH AN AMBIENT SHEAR FLOW (NON-CRITICAL FLOWS)

P. A. Blythe and Y. Kazakia Dec. 1971 38 p refs
(Contract DAAD05-69-C-0053; THEMIS Proj. 65)
(AD-738548; CAM-110-22; BRL-CR-61) Avail: NTIS CSCL 08/3

An analysis is given of the behavior of a gravity wave moving over a horizontal bed into a region where the flow is sheared in a vertical direction. No restriction is placed on the amplitude of the wave. The only assumptions made are that the fluid is inviscid and that the hydrostatic pressure law holds. The results can be used to analyze the behavior of tsunamis and weather fronts. It is shown that even with an arbitrary ambient shear, the variation in height of the free surface in a long progressing wave can be similar to that in a simple wave except that the local wave speed depends on the shear profile. The interaction of such a wave with a uniform shear is described in detail. Author (GRA)

N72-26328# Hawaii Inst. of Geophysics, Honolulu.

ENVIRONMENTAL OCEANOGRAPHIC OBSERVATIONS IN THE PACIFIC OCEAN NORTH OF HAWAII, 15 NOVEMBER - 5 DECEMBER 1969 Annual Technical Report, Nov. - Dec. 1969

Richard C. Latham Aug. 1971 56 p refs
(Contract N00014-67-A-0387-0004)
(AD-738432; HIG-71-12; ATR-4) Avail: NTIS CSCL 08/10

The USS Marysville (PCER 857), with scientific party from the Hawaii Institute of Geophysics, obtained oceanographic environmental data consisting of temperature and sound velocity profiles and bathymetry north of the Hawaiian Islands in support of PARKA II-A operations from 15 November to 5 December, 1969. Author (GRA)

N72-26329# Aerospace Corp., El Segundo, Calif. Lab. Operations.

INADVERTENT EXPERIMENTS INVOLVING WAVE-PARTICLE INTERACTIONS ON A GEOPHYSICAL SCALE: AN UNSUCCESSFUL SEARCH

George A. Paulikas 1 Mar. 1972 19 p refs
(Contract F04701-71-C-0172)
(AD-738653; TR-0172(2260-20)-15; SAMSO-TR-72-52) Avail: NTIS CSCL 04/1

A search has been made for unusual geophysical events associated with the creation of plasma clouds by the firing of large rocket engines outside of the plasmapause. These plasma clouds may develop into regions of strong wave-particle interaction which could give rise to magnetospheric effects. No evidence of unusual effects has been found. Author (GRA)

N72-26330# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.

AN INERTIAL OCEAN CURRENT PROFILER Final Report

Delbar P. Keily 31 Dec. 1971 17 p refs
(Contract Nonr-1841(74); NR Proj. 083-157)
(AD-738484; R-71-3) Avail: NTIS CSCL 14/2

A free-falling current meter for ocean use has been designed, based upon the inertial guidance platform used in the obsolete Atlas missile. An Atlas ground-based count-down system was rebuilt for monitoring the performance of the modified inertial platform. A temperature control system was built into the Arma lot D vibrating string accelerometer of the Atlas platform. Temperature drift was thereby reduced by nearly two orders of magnitude. This permitted the observations of accelerations as low as plus or minus three tenths of one microgee, which is equivalent to a resolution of horizontal currents of as little as one tenth of one centimeter per second. This potential resolution is exceeded by other inaccuracies in the proposed system. Author (GRA)

N72-26331# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

EFFECT OF GRID SIZE ON CUTOFF FREQUENCY IN THE NUMERICAL SOLUTION OF AN ELASTIC ONE-DIMENSIONAL WAVE PROPAGATION PROBLEM Final Report

Paul F. Hadala and Hugh M. Taylor, Jr. Feb. 1972 56 p refs
(AD-738533; AEWES-TR-S-72-2) Avail: NTIS CSCL 08/11

The Waterways Experiment Station one-dimensional (1D) finite difference ground motion calculation code was used to investigate the influences of grid size and acceleration convergence criteria on cutoff-frequency phenomena in the numerical solution of an elastic 1D wave propagation problem. Rise time to peak stress or particle velocity was shown to increase with increased grid size. In addition, the coarser the grid, the greater will be the overshoot of peak stress and velocity. Increasing AMIN, the acceleration convergence error tolerance in the code's numerical integration scheme, had a significant effect on the amplitudes but not the frequency of the oscillations that occurred in the 1D elastic finite difference computer code calculations. Author (GRA)

N72-26332# Royal Norwegian Council for Scientific and Industrial Research, Kjeller.

SYSTEM OPERATION REPORT Technical Report, 1 Jul. - 31 Dec. 1970

Feb. 1972 145 p refs
(Contract F19628-70-C-0283; ARPA Order 800)
(AD-739228; NORSAR-15; ESD-TR-72-134) Avail: NTIS CSCL 17/10

Phase III of NORSAR (Norwegian Seismic Array) contract covers essentially operation of the NORSAR project in the period 1 July 1970 - 30 June 1972. The array was built under previous contracts by the Norwegian Defence Research Establishment. Installations, originally planned to be completed by 1 July 1970, were somewhat delayed. As a consequence, the last part of the installation works and the start of operations run parallel during the period of this report. This report gives a summary of the various efforts in the period. Author (GRA)

N72-26333# Raytheon Co., Sudbury, Mass.

HF RADAR MEASUREMENTS OF PEAK ELECTRON DENSITY DURING TESTS CANUTO AND DARDABASI OF OPERATION BARBIZON Final Technical Report

George D. Thome and David W. Blood Jan. 1972 27 p refs
(Contract F30602-68-C-0299; ARPA Order 1057; Proj. Secede)
(AD-738695; RADC-TR-72-23) Avail: NTIS CSCL 04/1

Tests Canuto and Dardabasi of Operation BARBIZON tested two new payload chemistries for producing ionized clouds in the upper atmosphere. Two 16 kg releases were made during each test, a standard chemistry release on the up-leg and a new chemistry release at the same altitude on the down-leg. The new chemistries were developed for test Canuto by Thiolol and for test Dardabasi by Space Data. Raytheon provided HF radar measurements of the peak electron density on each cloud as a function of time. Author (GRA)

N72-26837 Westinghouse Research Labs., Pittsburgh, Pa.

SINE BEAT VIBRATION TESTING RELATED TO EARTHQUAKE RESPONSE SPECTRA

E. G. Fischer *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 1-9 refs (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26839 California Univ., Livermore. Lawrence Livermore Lab.
SHOCK INPUT FOR EARTHQUAKE STUDIES USING GROUND MOTION FROM UNDERGROUND NUCLEAR EXPLOSIONS
D. L. Bernreuter, D. M. Norris, Jr., and F. J. Tokarz *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 21-31 refs Sponsored in part by AEC (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26729*# Techtran Corp., Glen Burnie, Md.
DETERMINATION OF THE SEMI-DIURNAL PRESSURE VARIATIONS IN THE UPPER ATMOSPHERE
G. M. Teptin *In its* Meteoric Propagation of Radio Waves May 1972 p 134-138 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 04A

N72-26765*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BEARING STRENGTH OF THE LUNAR SOIL
L. D. Jaffe *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 227-232 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 08M

N72-26766*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CRACKING OF THE LUNAR SOIL
L. D. Jaffe *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 233-235 (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 08M

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N72-26334 Idaho Univ., Moscow.
THIRTY-FIVE MILLIMETER COLOR OBLIQUE AERIAL PHOTOGRAPHY AS A TOOL FOR RECONNAISSANCE EXPLORATION FOR URANIUM MINERALIZATION IN THE TERTIARY BASINS OF WYOMING Ph.D. Thesis
Stanley Cameron Grant 1971 236 p
Avail: Univ. Microfilms Order No. 72-2083

An evaluation of techniques, films, and procedures for 35mm color aerial photography in uranium mineral exploration is presented. The Tertiary rocks of the Clarkson Hill-Rattlesnake Range area, 22 miles southwest of Casper, Wyoming, were studied. The Munsell Color System was selected to identify the color in soils and rocks. Soil and rock samples were analyzed by qualitative emission spectrography to determine possible controls for color. Interpretation of analyses supports findings of others that colors result from oxides of iron in varying quantities. The geology of the primary area was studied to provide an accurate ground basis for aerial photography and to determine locations favorable for uranium mineralization. Tertiary formations and structure were mapped. Dissert. Abstr.

N72-26335 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
AN ASTATIC MAGNETOMETER WITH NEGATIVE FEEDBACK
J. L. Roy, J. Reynolds, and E. Sanders 1972 19 p refs
Copyright. Avail: Issuing Activity

An astatic magnetometer designed for the measurement of weakly magnetized rock specimens is described with special reference to a magnetic control method as a means of improving both the performance and efficiency of the instrument. It is shown that for high sensitivity and rapid response, the two magnets should be long and thin, magnetized perpendicular to the long axis, and that the moment of inertia of each magnet should be 1/4 the moment of inertia of the whole suspended system. In general, magnetic materials of high coercive force give the best design. Author

N72-26336*# Arizona State Univ., Tempe. Solid State Research Lab.
INVESTIGATION OF OPTICAL/INFRARED SENSOR TECHNIQUES FOR APPLICATION SATELLITES Final Report
Irving Kaufman 18 May 1972 77 p refs
(Grant NGR-03-001-052)
(NASA-CR-127109; SSRL-132) Avail: NTIS HC $6.00 CSCL 14B

A method of scanning an optical sensor array by acoustic surface waves is discussed. Data cover detailed computer based analysis of the operation of a multielement acoustic surface-wave-scanned optical sensor, the development of design and operation techniques that were used to show the feasibility of an integrated array to design several such arrays, and experimental verification of a number of the calculations with discrete sensor devices. Author

N72-26337*# National Aeronautics and Space Administration, Washington, D.C.
SPACE VEHICLE DISPLAYS DESIGN CRITERIA NASA Space Vehicle Design Criteria (Guidance and Control)
Mar. 1972 45 p refs
(NASA-SP-8086) Avail: NTIS HC $3.00 CSCL 22B

The guidance, navigation, and control displays associated with manned spaceflight are summarized. Major emphasis were placed on methodologies useful for determining necessary information and its uses, systems analysis techniques, and analytic methods for design and evaluation of such systems. Author

N72-26338*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF AN AIR FLOW THERMAL BALANCE CALORIMETER
Joseph M. Sherfey Washington Jun. 1972 41 p refs
(NASA-TN-D-6750; G-1041) Avail: NTIS HC $3.00 CSCL 14B

An air flow calorimeter, based on the idea of balancing an unknown rate of heat evolution with a known rate of heat evolution, was developed. Under restricted conditions, the prototype system is capable of measuring thermal wattages from 10 milliwatts to 1 watt, with an error no greater than 1 percent. Data were obtained which reveal system weaknesses and point to modifications which would effect significant improvements. Author

N72-26339*# Translation Consultants, Ltd., Arlington, Va.
THE EFFECT OF INPUT POTENTIALS ON THE CHARACTERISTICS OF THE SENSOR OF A RADIO FREQUENCY MASS SPECTROMETER

Ye. N. Yevlanov and V. A. Yershova Washington NASA Jun. 1972 21 p refs Transl. into ENGLISH of "O Vliyanii Vkhodnykh Potentsialov na Kharakteristiki Datchika Radiochastotnogo Mass-spektrometra", Rept. Pr-75, Inst. of Space Res., Acad. of Sci. (USSR), Moscow, 1971 24 p
(Contract NASw-2038)
(NASA-TT-F-14236; Pr-75) Avail: NTIS HC $3.25 CSCL 14B

The results of a study of the characteristics of a radio frequency mass spectrometer analyzer from the point of view of the effect of satellite potential and that of the analyzer pulling (input) grid potential on sensitivity are presented. The measurements were made using a special installation simulating a flux of rarefied ionospheric plasma with parameters typical of orbital flight conditions with speeds of from 5 to 10 km/sec. Relationships between sensor sensitivity in the ion composition analysis mode and input potentials of plus or minus 50 V are obtained, as are some data on the characteristics of a mass spectrometer when analyzing a neutral composition and against analyzer background currents. Author

N72-26340*# National Aeronautics and Space Administration, Washington, D.C.
GLASS FILTER ELECTRICAL MOISTURE BLOCK AND SELF-RECORDING MOISTURE METER FOR MEASURING SOIL MOISTURE
F. Yoshikazu and N. Tsutomu Jun. 1972 16 p Transl. into ENGLISH from Agr. Eng. Soc. of Japan (Tokyo), no. 9, Oct. 1964 p 5-10
(NASA-TT-F-14292) Avail: NTIS HC $3.00 CSCL 14B

In the measurement of soil moisture under field conditions, it is desirable to cover continuously a wide range of moisture. To meet these requirements, nylon electrical resistance units and plaster blocks, introduced by Bouyoucos and Mick, are generally used. However, these resistance units still have various disadvantages. Absorbing, blocks of high sensitivity over a wide range of soil moisture were investigated for overcoming these disadvantages. The glass-filter electrical resistance block was found to be most effective, and its characteristics were measured. The glass-filter block has internal electrodes similar in principle to those of former units. This block furnishes a very good method for measuring soil moisture from saturation to almost wilting point, and the block is durable. Author

N72-26341# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
REPORT ON THE SECOND MEETING OF THE DGLR-SCIENTIFIC COMMITTEE OF THE GERMAN AEROSPACE SOCIETY [BERICHT UBER DIE 2 SITZUNG DES DGLR-FACHAUSSCHUSSES VERSUCHSWESEN DER STROEMUNGSMECHANIK]
Feb. 1972 169 p refs In GERMAN; partly in ENGLISH Meeting held in Bremen, 6 Apr. 1971
(DLR-Mitt-72-06) Avail: NTIS HC $10.50; ZLDI Munich: 37,80 DM

Wind tunnel balances with strain gage systems for measurements of quasi-stationary aerodynamic force coefficients in wind tunnels are reported. For individual titles, see N72-26342 through N72-26349.

N72-26342# Hamburger Flugzeugbau G.m.b.H. (West Germany).
SUBSONIC WIND TUNNEL BALANCES WITH DMS SYSTEMS [UNTERSCHALLWINDKANALWAAGEN MIT DMS-SYSTEMEN]
F. Waesche and A. Vasel *In* DGLR Rept. on the 2d Meeting of the DGLR-Sci. Comm. of the Ger. Aerospace Soc. Feb. 1972 p 7-24 In GERMAN (See N72-26341 17-14)
Avail: NTIS HC $10.50; ZLDI Munich: 37,80 DM

Construction and properties of mechanical and electrical wind tunnel balances with strain gages are considered. Performance tests of these balances in subsonic wind tunnels show that their accuracies are determined mainly by the precision classification of the instrument and its connected amplifiers. It is shown that strain gages with inductive systems require a minimum in measuring time but that mechanical balances provide more precision in measurements. Transl. by G.G.

N72-26343# Eidgenossisches Flugzeugwerk, Emmen (Switzerland).
THE DEVELOPMENT OF A DMS BALANCES SERIES FOR SIX COMPONENT MEASUREMENTS OF MODELS OR MODEL PARTS IN SUBSONIC WIND TUNNELS [DIE ENTWICKLUNG EINER DMS-WAAGENREIHE FUER 6-KOMPONENTENMESSUNGEN AN MODELLEN ODER MODELLTEILEN IN UNTERSCHALLWINDKANAELEN]
B. Baeriswyl *In* DGLR Rept. on the 2d Meeting of the DGLR-Sci. Comm. of the Ger. Aerospace Soc. Feb. 1972 p 25-42 refs In GERMAN (See N72-26341 17-14)
Avail: NTIS HC $10.50; ZLDI Munich: 37,80 DM

A six component strain gage balance is reported for determining the interferences forces of two aircrafts during surveillance flights, and for measuring exterior loads and moments in order to determine acceptable loads for aircraft side suspension. Transl. by G.G.

N72-26344# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik Forschungszentrum.
EXTERNAL STAIN GAUGE BALANCES FOR THREE COMPONENT MEASUREMENTS IN SUBSONIC WIND TUNNEL [EXTERNE DEHNUNGSMESSSTREIFENWAGEN FUER DREIKOMPONENTENKRAFTMESSUNGEN IM UEBERSCHALLWINDKANAL]
G. Kausche *In* DGLR Rept. on the 2d Meeting of the DGLR-Sci. Comm. of the Ger. Aerospace Soc. Feb. 1972 p 43-69 refs In GERMAN (See N72-26341 17-14)
Avail: NTIS HC $10.50; ZLDI Munich: 37,80 DM

An external strain gage balance for measuring three components on supersonic wind tunnel models is reported. Adjustment of the various measuring elements for tangential-, normal force-, and pitch moment-loads improves measuring precision and interference behavior but does not eliminate nonlinear interference properties. Some aerodynamic example measurements are included. Transl. by G.G.

N72-26345# Aircraft Research Association, Ltd., Bedford (England).
WIND TUNNEL BALANCE STRAIN GAUGING TECHNIQUES
A. Pendleton *In* DGLR Rept. on the 2d Meeting of the DGLR-Sci. Comm. of the Ger. Aerospace Soc. Feb. 1972 p 71-83 (See N72-26341 17-14)
Avail: NTIS HC $10.50; ZLDI Munich: 37,80 DM

For static measurements using internal sting balances and control surface balances, temperature compensated foil gages encapsulated in phenolic glass are used exclusively. For dynamic measurements the same gauges are used if the signals are large enough, otherwise encapsulated semiconductor gauges are applied. The use of four active strain gauges wired in a bridge circuit has the following advantages: (1) the signal output is four times greater; (2) the effects of temperature are largely cancelled; (3) the effect of variation in intergauge wiring resistance due to temperature is minimized; and (4) interactions of other loads and moments are also minimized. Author

N72-26346# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
FACILITY CONNECTED ERROR EFFECTS UP TO 0.1 PERCENT IN WIND TUNNEL BALANCES WITH STRAIN GAUGE SYSTEMS [ANLAGENBEDINGTE STOEREINFLUESSE BIS IN DEN BEREICH VON 0,1 PERCENT BEI WINDKANALWAAGEN MIT DEHNUNGSMESSSTREIFENSYSTEMEN]
P. J. Weber *In* DGLR Rept. on the 2d Meeting of the DGLR-Sci. Comm. of the Ger. Aerospace Soc. Feb. 1972

p 85-101 refs In GERMAN (See N72-26341 17-14)
Avail: NTIS HC $10.50; ZLDI Munich: 37,80 DM

Thermal and mechanical effects of wind tunnels produce balance measurement errors. Interpretation of apparent strain values as functions of error effects for data storage and correction combines multiple temperature effects into one systematic error analysis. Transl. by G.G.

N72-26347# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).

WIND TUNNEL TESTS TO DETERMINE THE INSTATIONARY AERODYNAMIC DERIVATIVES ON A MODEL OF A TWIN BRIDGE

J. W. G. vanNunen, A. J. Persoon, and H. Tijdeman *In* DGLR Rept. on the 2d Meeting of the DGLR-Sci. Comm. of the Ger. Aerospace Soc. Feb. 1972 p 103-128 refs (See N72-26341 17-14)
Avail: NTIS HC $10.50; ZLDI Munich: 37,80 DM

Measurements were carried out on a model of a twin-bridge to determine the instationary aerodynamic loads needed to perform stability calculations. The measuring procedure, based on an inertia compensated balance system, has been described and to demonstrate the applicability thereof, some results are presented and discussed. Author

N72-26348# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).

DERIVATION MEASUREMENTS IN SUPERSONIC WIND TUNNELS BY FREE OSCILLATION METHOD [DERIVATIVAMESSUNGEN NACH DER METHODE DER FREIEN SCHWINGUNGEN IM UEBERSCHALLWINDKANAL]

N. Treinies *In* DGLR Rept. on the 2d Meeting of the DGLR-Sci. Comm. of the Ger. Aerospace Soc. Feb. 1972 p 129-151 ref In GERMAN (See N72-26341 17-14)
Avail: NTIS HC $10.50; ZLDI Munich: 37,80 DM

Dynamic stability derivation measurements on aerodynamic models in supersonic wind tunnels by a freely oscillating balance system are discussed. A cross spring joint in the balance acts as linear oscillator and provides velocity proportional damping at small angles. Spring constant and damping are reproducable values in calibration trials. Transl. by G.G.

N72-26349# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

BUFFETING MEASUREMENTS ON A WING-BODY-MODEL WITH STRAIN GAUGES AT THE WINGS [BUFFETING-MESSUNGEN AN EINEN FLUEGEL-RUMPF-MODELL MIT DEHNMESSTREIFEN AM FLUEGEL]

R. Vanino *In* DGLR Rept. on the 2d Meeting of the DGLR-Sci. Comm. of the Ger. Aerospace Soc. Feb. 1972 p 153-178 refs In GERMAN (See N72-26341 17-14)
Avail: NTIS HC $10.50; ZLDI Munich: 37,80 DM

The buffeting behavior of four differential airfoil geometries was studied in wind tunnel tests by determining bending moment oscillations at the wing-body roots through a strain gage. Analyses of dynamic gage signals indicated that a thin, slightly pointed wing is aerodynamically superior to a thicker, strongly pointed airfoil under similar buffeting conditions. Transl. by G.G.

N72-26350# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Werkstoff-Forschung.

APPARATUS FOR FATIGUE TESTS IN VACUUM BETWEEN ROOM TEMPERATURE AND 77 K

V. Bachmann, M. Boehmer, and D. Munz Feb. 1972 54 p refs In GERMAN; ENGLISH summary
(BMBW-FB-W-72-05) Avail: NTIS HC $4.75; DFVLR Munich: 11.15 DM

A device for testing the mechanical properties, especially the fatigue behavior, in vacuum and low temperatures is described. The apparatus consists of a vacuum chamber, the loading rods, the cooling circuit and a servohydraulic testing machine. The possible testing conditions are as follows: (1) pressure range between 760 torr and 5 x 10 to the minus 8th power torr, (2) temperature range between room temperature and 77 K (continuously adjustable), (3) strain rates in tensile tests up to 1 m/sec, and (4) frequency in fatigue tests up to 50 Hz. A further extension of the apparatus for tests at temperatures of liquid hydrogen is possible. Author

N72-26351*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A PROBE FOR MEASURING TEMPERATURE AND PRESSURE AT THE SAME POINTS IN A GAS STREAM

Lloyd N. Krause, George E. Glawe, and Thomas J. Dudzinski Washington Jun. 1972 12 p refs
(NASA-TM-X-2577; E-6840) Avail: NTIS HC $3.00 CSCL 14B

Design features and characteristics of a means for measuring total temperature and total pressure at a single point in a gas stream are presented. A rake that provides five such combination measurements is described. Experimental data are included for the aerodynamic recovery and time response of the temperature sensor and for the flow-angle sensitivity of both the temperature and pressure sensors. Data were obtained over a subsonic Mach number range of 0.3 to 0.9 as well as at a Mach number of 1.4. Author

N72-26352# Joint Publications Research Service, Arlington, Va.

SETTING STANDARDS FOR THE INSTRUMENT MAKING INDUSTRY

P. V. Novitskiy 19 Jun. 1972 8 p refs Transl. into ENGLISH from Pribory i Sistemy Upr. (Moscow), no. 4, 1972 p 12-13
(JPRS-56298) Avail: NTIS HC $3.00

Reviewed are concepts and definitions employed in the formulation of all-union standards in the area of instrument making. Several standards are used to point out the lack of coordination within the industry. Author

N72-26353# Joint Publications Research Service, Arlington, Va.

THEORY OF THE GENERALIZED GYROINSTRUMENT

Yu. A. Buryan 20 Jun. 1972 9 p refs Transl. into ENGLISH from Izv. Vysshikh Ucheb. Zavedenii-Priborostr. (Leningrad), v. 10, no. 7, 1967 p 85-91
(JPRS-56317) Avail: NTIS HC $3.00

The principal of a generalized gyroinstrument is provided and the derivation of motion equations for the axis of the instrument's figure in a general case of the base's movement is described. Author

N72-26354*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HYBRID TE PANEL TEST RESULTS

William J. Bifano 1972 12 p refs Proposed for presentation at 7th Intersoc. Energy Conversion Eng. Conf., San Diego, Calif., 25-29 Sep. 1972
(NASA-TM-X-68087) Avail: NTIS HC $3.00 CSCL 14B

Test results are presented for a nine couple (3 x 3 array) thermoelectric panel of hybrid thermocouples. In the hybrid couple, a hollow cylinder of p-type Si-Ge is used to encapsulate a segmented PbTe/Si-Ge n-leg. The hybrid couple is predicted to offer a 10- to 15-percent improvement in performance relative to all Si-Ge couples. The efficiency, output power, and internal resistance of the panel as well as the resistances of the individual hybrid couples are presented as a function of test time covering a period of more than 2600 hours. Initial test results indicated hybrid couple performance consistent with design predictions. Extraneous resistance ranged from 20 to 25% of the hybrid couple thermoelectric resistance. Author

N72-26355# Defence Standards Labs., Maribyrnong (Australia).

EVALUATION OF AN ELECTROSTATIC AEROSOL SAMPLER

G. H. Thomson Jan. 1972 14 p refs
(TN-219) Avail: NTIS HC $3.00

The efficiency of an MSA electrostatic analyser is investigated as a function of flow rate, applied voltage, particle size and concentration of particulate matter. The characteristics of the efficiency flow rate and efficiency particle size curves are significantly different from theoretical predictions. Author

N72-26356# Lockheed Missiles and Space Co., Palo Alto, Calif.

NEUTRON MONITOR ON AN ARTIFICIAL EARTH SATELLITE WITH A HIGHLY ELLIPTICAL ORBIT

P. I. Shavrin, Iu. A. Samonenko, Iu. A. Razumov, B. V. Marin, E. A. Devicheva, and V. P. Borodulin 25 Aug. 1971 6 p refs
Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 12, no. 2, 1972 p 184-187
Avail: NTIS HC $3.00; National Translations Center, John Crear Library, Chicago, Ill. 60616

A brief description is given of the neutron monitor on the Molniya-1 launched on 27 Nov. 1970 into a semi-synchronous orbit. The efficiency of the method proposed to determine the intensity and energy spectrum of solar protons is demonstrated by the example of an analysis of data obtained during the proton flare of 25 Jan. 1971. Author

N72-26357# Goodyear Atomic Corp., Piketon, Ohio.

DEVELOPMENT OF A SYSTEM TO MAKE QUANTITATIVE MEASUREMENTS WITH THE ELECTRON MICROPROBE M.S. Thesis - Ohio Univ.

David E. Boyd 28 Aug. 1971 103 p refs
(Contract AT(33-1)-1)
(GAT-T-1749) Avail: NTIS

A systems engineering analysis is applied to the development of a system for making routine quantitative measurements with an electron microprobe. A systems approach is used because making quantitative measurements with the electron microprobe involves the integration of many activities into a single, efficiently operating system that must meet specific requirements and is bounded by definite constraints. Activities integrated into a system include data collection formatting for the microprobe, recording the X-ray intensity data, conversion of X-ray intensities to weight percent composition, and reporting of the calculated results. The data collection format must be designed for a manually operated microprobe. All data reduction work is to be performed on the IBM 1410 computer. Author

N72-26358# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

VISUALIZATION OF AERODYNAMIC FLOWS IN COMPRESSORS BY HOLOGRAPHIC INTERFEROMETRY Thesis - Paris Univ., 20 Dec. 1971 [VISUALISATION D'ECOULEMENTS AERODYNAMIQUES DANS LES COMPRESSEURS PAR INTERFEROMETRIE HOLOGRAPHIQUE]

Jean-Marie Caussignac 1972 41 p refs In FRENCH; ENGLISH summary
(ONERA-NT-190) Avail: NTIS HC $4.25

The advantages of holography over other visualization methods and its disadvantages are presented. Only a retrodiffusion holographic set-up is necessary, as the turbomachine hub is opaque. The blade-carrying hub is used as the diffusing surface. The difficulty in using such a method is that the experimental conditions are severe. During the run, the hub vibrates and heats. During processing, these deformations entail spurious fringes often difficult to interpret. A preliminary study of the influence of various fundamental diffuser displacements is described, and some examples are presented of the interferograms obtained in wind tunnel. Author (ESRO)

N72-26359# European Space Research and Technology Center, Noordwijk (Netherlands).

THE DETERMINATION OF THE EMISSIVITY OF A HELIOS SOLAR-CELL-ARRAY SAMPLE WITH THE AGA-THERMOVISION CAMERA

M. Janes and B. G. M. Aalders Paris ESRO Jan. 1971 32 p refs
(ESRO-TN-106-ESTEC) Avail: NTIS HC $3.75

The application of the AGA thermovision camera, normally used to determine surface temperature distributions, to emissivity measurement of solar cells, is explained. The camera is sensitive to near infrared radiation, and permits the production of a black and white picture of temperature distribution on an oscilloscope screen. The method is based on independent measurement of surface temperature by thermocouples as well as by the camera. The value of the emissivity can be derived from the data. The expected error associated with the method was calculated. The surface examined was a substrate on which solar cells and second surface mirrors were glued in the regular arrangement specially designed for the Helios satellite. The emissivity values of both solar cells and mirrors were determined. Author (ESRO)

N72-26360# California Univ., Richmond. Inst. of Transportation and Traffic Engineering.

HEAD UP DISPLAY STUDY Final Report

Don D. Horning, D. M. Finch, Karl Mellander, and Alvah Miller May 1971 167 p refs
(AD-738591; FAA-RD-71-60) Avail: NTIS CSCL 01/4

The study objectives were to investigate effects of a Head-Up Display on a pilot's ability to see runway lights in fog. Methods of evaluation of the Head-Up Display concept under low visibility conditions were developed. Various physical parameters were measured. Luminance of the Head-Up Display, cockpit interior, and external scent were measured with a Pritchard Telephotometer at 30 minute arc intervals. The 'scene' was examined for glare sources and analyzed for the adaptation level which could be expected by a pilot. Under normal operating conditions with the visibility range 1200 ft, day or night, no glare sources were identified and adaptation levels were reasonable. It was concluded from these objective measurements that the Head-Up Display unit tested would not adversely affect pilot's ability to see runway lights in fog. Author (GRA)

N72-26361# General Electric Co., Schenectady, N.Y.

UNIT RECORD CARD GRAPHIC TECHNIQUES Semiannual Technical Report, 1 Jun. - 30 Nov. 1971

John E. Bigelow and Siegfried Aftergut Fort Monmouth, N. J. ECOM Feb. 1972 32 p
(Contract DAAB07-71-C-0073; DA Proj. 1H6-62701-A-484)
(AD-738597; S-71-1144; ECOM-0073-2; SATR-2) Avail: NTIS CSCL 14/5

Work during the second six months of an 18 month program to develop graphical techniques for a reusable unit record card based on photoplastic film is described. Following a compromise on resolution to get better contrast, the film equipment, and processing were optimized. The results look sharp and of good contrast by projection and in facsimile copies. The goal of reuse 15 times was successfully demonstrated. Author (GRA)

N72-26362# Purdue Univ., Lafayette, Ind.

INVESTIGATION OF PARTICLE-SIZE DETERMINATION FROM THE OPTICAL RESPONSE OF A LASER DOPPLER VELOCIMETER

D. G. Andrews (Stanford Univ.) and H. S. Seifert (Stanford Univ.) Feb. 1972 68 p refs
(Contract N00014-67-A-0226-0005; NR Proj. 098-038)
(AD-738873; SQUID-TR-SU-1-PU; SUDAAR-435) Avail: NTIS CSCL 14/2

The intensity of laser light back-scattered from a particle and transmitted by a Fabry-Perot interferometer is used to determine particle-size. The instrument's optics and electronics are calibrated by examining stationary particles of known diameter resting on a non-reflective glass slide. The response of the instrument is determined by comparing measured intensities with theoretical values calculated as a complex function of particle size, refractive index and ray geometry. The results show that the measured intensities do approximate the theoretical

variation with particle size and in the range of particle diameters measured (1-10 microns), the error is less than one micron.
Author (GRA)

N72-26363# Naval Air Test Center, Patuxent River, Md.
A STUDY OF AIRPLANE TOUCHDOWN DATA MEASURING DEVICES USED DURING CARRIER SUITABILITY STRUCTURAL TESTS
C. P. Senn 14 Mar. 1972 24 p refs
(AD-738811; NATC-FT-TM-1-72) Avail: NTIS CSCL 14/5

The report contains the results of a statistical study of the reading accuracy of the Photo-Sonics 35mm - 4M camera. The reading accuracy limits of the Photo-Sonics camera must be increased (a decrease in accuracy) above those stated for the Cameraflex. However, this should not imply that the Photo-Sonics camera is less accurate than the Cameraflex. The opposite of this is the case. Additionally, the improvement in the reading accuracy of the Photo-Sonics camera coverage is supported by the data showing the reduction in the sink speed standard deviation from 0.34 fps for the Cameraflex to 0.27 fps for the Photo-Sonics camera. Author (GRA)

N72-26364# Harry Diamond Labs., Washington, D.C.
FLUIDIC STRAIN GAGE CONCEPTS
Tadeusz M. Drzewiecki Dec. 1971 29 p refs
(DA Proj. 1T0-61102-A-33-B)
(AD-738794; HDL-TR-1575) Avail: NTIS CSCL 14/2

The need to measure elongation, strain, stress and deformation without resorting to electronic devices has given rise to the development of a fluidic strain gage. The principle of operation of the fluidic strain gage is the same as for its electronic counterpart, namely the change in resistance with change in length. Four generic active devices which cover, in general, the whole field are described. GRA

N72-26365# Bell Aerospace Co., Buffalo, N.Y.
A 3 AXIS ACCELEROMETER (MESA) FOR CANNONBALL 2 R/D Equipment Information Report
William G. Lange and Murray A. Meldrum 15 Jun. 1971 22 p
(Contract F19628-71-C-0165; AF Proj. 8605)
(AD-738657; Rept-6098-954002; AFCRL-71-0501) Avail: NTIS CSCL 14/2

A triaxial accelerometer system was developed for flight on the Cannon Ball 2 satellite (OAR 901). This report provides the necessary operating and diagnostic instructions for this research equipment. Included are operation and calibration instructions, interconnection diagrams, logic diagrams, schematics and assembly drawings. GRA

N72-26366# Yale Univ., New Haven, Conn.
EXPERIMENTS ON THE STARTING PROCESS IN A LUDWIEG TUBE Interim Report, Jun. 1970 - Jan. 1972
Dominic J. Cagliostro Arnold AF Sta., Tenn. AEDC Mar. 1972 54 p refs
(Contract F40600-70-C-0008)
(AD-738723; AEDC-TR-72-42) Avail: NTIS CSCL 14/2

An experimental investigation of the starting process in the Ludwieg tube, an intermittent type tube wind-tunnel, was conducted with emphasis on the effects of nozzle-test section geometry. In particular the semi-open and closed jet configuration was studied. Dry air at 1.0 and 2.0 atm pressure and room temperature was used in the supply tube and a quick opening diaphragm located downstream of the nozzle and test section was employed to initiate the flow. Spark shadowgraph pictures, high-speed shadowgraph movies, streak interferograms, and pressure measurements were made in M = 1.67 and 3.0 continuously expanding nozzles and M = 1.6 and 2.5 parallel flow nozzles. Results show that the nozzle-test section geometry significantly affects the starting process in the M = 1.60 and 1.67 nozzles. Author

N72-26367# Naval Ordnance Lab., White Oak, Md.
REDUCTION OF SCATTER IN UNDERWATER SHOCK WAVE MEASUREMENTS MADE WITH PIEZOELECTRIC GAGES
Joseph B. Dempsey and Robert S. Price 4 Feb. 1972 21 p refs
(AD-739319; NOLTR-72-12) Avail: NTIS CSCL 14/2

For many years measurements of the shock wave from underwater explosions have been made using tourmaline piezoelectric gages. The results have shown considerable scatter, the source of which has been extremely difficult to determine. As the result of recent work, it is now evident that much of the scatter has been caused by spurious electrical charges generated in or by the gage waterproofing material, and it can be eliminated or substantially reduced by waterproofing the gage with an oil-filled boot. GRA

N72-26830 Naval Research Lab., Washington, D.C.
DEVELOPMENT OF A ROUGH ROAD SIMULATOR AND SPECIFICATION FOR TESTING OF EQUIPMENT TRANSPORTED IN WHEELED VEHICLES
Harold M. Forkois and Edward W. Clements *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 169-190 refs (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26838 Battelle Memorial Inst., Columbus, Ohio.
SEISMIC EVALUATION OF ELECTRICAL EQUIPMENT FOR NUCLEAR POWER STATIONS
Robert H. Prause and Donald R. Ahlbeck *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 11-20 refs (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26898 General American Transportation Corp., Niles, Ill. Research Div.
DIAL PACK BLAST DIRECTING EXPERIMENT
I. E. Fugelso, S. F. Fields, and W. J. Byrne *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 175-184 refs (See N72-26882 17-32)
(Contract DASA01-70-C-0107)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26905 Advanced Technology Center, Inc., Dallas, Tex.
BANDWIDTH TIME CONSIDERATIONS IN AUTOMATIC EQUALIZATION
Charles T. Morrow *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 1-7 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26910 Naval Weapons Lab., Dahlgren, Va.
INSTRUMENTATION TECHNIQUES AND THE APPLICATION OF SPECTRAL ANALYSIS AND LABORATORY SIMULATION TO GUN SHOCK PROBLEMS
D. W. Culbertson and V. F. DeVost (NOL, White Oak, Md.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 47-59 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26389*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA-ARC 36 INCH AIRBORNE INFRARED TELESCOPE
R. E. Mobley and R. M. Cameron *In its* 6th Aerospace Mech.

Symp. Jun. 1972 p 81-88 refs (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 20F

N72-26391*# Beckman Instruments, Inc., Fullerton, Calif.
SHUTTER MECHANISM FOR SPACECRAFT SPECTROPHOTOMETER
August Weilbach *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 95-100 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 14B

N72-26745*# California Inst. of Tech., Pasadena.
EXAMINATION OF THE SURVEYOR 3 SURFACE SAMPLER SCOOP
R. F. Scott and K. A. Zuckerman *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 100-114 refs Original contains color illustrations (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 14B

N72-26756*# Chicago Univ., Ill.
EXAMINATION OF RETURNED SURVEYOR 3 CAMERA VISOR FOR ALPHA RADIOACTIVITY
T. E. Economou and A. L. Turkevich *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 177-180 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 14B

N72-26758*# United States Steel Corp., Monroeville, Pa.
HIGH VOLTAGE TRANSMISSION MICROSCOPY OF SURVEYOR 3 CAMERA SHROUDS
R. M. Fisher, W. R. Duff, L. E. Thomas, and S. V. Radcliffe (Case Western Reserve Univ., Cleveland, Ohio) *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 184-196 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 14B

N72-26772*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SURVEYOR TELEVISION CAMERA, SELECTED MATERIALS AND ELECTRONIC COMPONENTS, APPENDIX C
W. F. Carroll *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 278-283 (See N72-26731 17-30)
Avail: NTIS;SOD $4.00 CSCL 14B

N72-26661# Joint Publications Research Service, Arlington, Va.
SEMICONDUCTOR NUCLEAR RADIATION DETECTORS
S. M. Ryvkin, O. A. Matveyev, S. R. Novikov, and N. B. Strokan *In its* Varieties of Semicond. Mater. 20 Jun. 1972 p 1-30 refs (See N72-26660 17-26)
Avail: NTIS HC $4.75

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication; friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N72-26368 National Lending Library for Science and Technology, Boston Spa (England).
HIGH PRESSURE COMPACTION OF OXIDES
W. Poch 24 Mar. 1972 10 p refs Transl. into ENGLISH from Ber. Deut. Keram. Ges. (Bad honnef/rhein), v. 46, no. 2, 1969
(NLL-Z-385-(7384.330)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Magnesia and alumina samples, with particle sizes ranging from 0.03 to 90 microns, were compacted at 20 C under approximately hydrostatic pressure. The powders could be compacted to 95% theoretical density by pressures of the order of 65 kbar. Compaction is brought about by particle re-arrangement (up to 60% theoretical density); further compaction is due to particle fragmentation or deformation. With magnesia, deformation commences at less than 10 kbar, and the contribution of particle fragmentation to the increase in density is small. In the lower pressure range, alumina particles tend to fragment; deformation occurs above 25 kbar. The compaction process depends not only on the properties of the material, but also on its particle size.
Author

N72-26369 National Lending Library for Science and Technology, Boston Spa (England).
KNIFELINE CORROSION OF AUTOMATIC WELDS IN CORROSION-RESISTANT STEELS
V. Cihal and N. Lehka Jan. 1972 6 p refs Transl. into ENGLISH from Werkstoffe Koprosion (Weinheim), v. 22, 1971 p 768-774 In ENGLISH and GERMAN
(NLL-Trans-746-1162-(9022.401)) Avail: National Lending Library, Boston Spa, Engl: 1 NLL photocopy coupon

Findings relating to intercrystalline and knifeline corrosion derived on superheated specimens of stabilized, austenitic, corrosion resistant steels and electroslag welds were applied to welds obtained with automatic welding equipment. Preliminary tests showed that damage due to knifeline corrosion, which was studied in detail in the specimens, also occurs in automatic welds, but the width of the attack is smaller by approximately one order of magnitude (a few tenths of a millimeter). Author

N72-26370 National Lending Library for Science and Technology, Boston Spa (England).
BORONIZING
Toshio Katagiri and Kyoko Fujii Apr. 1972 29 p refs Transl. into ENGLISH from Kinzoku Hyomen Gijutsu (Tokyo), v. 22, no. 5, 1971 p 32-40, 238-246
(NLL-RTS-7002) Avail: Natl. Lending Library, Boston Spa, Engl.: £2.80: 9 NLL photocopy coupons

Based on published experimental data, boronizing steel surfaces to obtain a hard layer on the metal is discussed. The methods discussed for obtaining boronized layers include solid state, salt bath, electrolytic, and gaseous. The hardness and wear resistance of the layer are discussed along with the effects of alloying elements. It is concluded that the gaseous boronizing treatment is the most advantageous as a surface hardening method. F.O.S.

N72-26371* Aeroflex Labs., Inc., Plainview, N.Y.
ROTARY ACTUATOR Patent
Charles Kallins and Jerome Ostroff, inventors (to NASA) Issued 23 May 1972 5 p Filed 4 Jun. 1970 Supersedes N72-21478 (10 - 12, p 1617) Sponsored by NASA
(NASA-Case-NPO-10244; US-Patent-3,664,185; US-Patent-Appl-SN-43327; US-Patent-Class-73-136R; US-Patent-Class-308-2A) Avail: US Patent Office CSCL 13I

A rotary actuator is described which is suited for use in environments wherein rolling and sliding friction is to be avoided, such as in a high vacuum celestial space environment. It is characterized by the utilization of a plurality of spaced tri-flex pivots each having a linear torque angle characteristic over its operative range adapted continuously to support the shaft in concentric alignment within a tubular housing and an electrically energizable torquer. This latter has linear torque current characteristics over its operating range magnetically coupled with the shaft for imposing rotation thereto for rotating the shaft against the bias of the tri-flex pivots. An ammeter is electrically coupled with the torquer for providing an output indicative of the current being supplied to the torquer and hence the angular position of the shaft. Official Gazette of the U.S. Patent Office

N72-26372 National Lending Library for Science and Technology, Boston Spa (England).
EFFECTS OF DIFFERENT TECHNOLOGICAL FACTORS ON THE FORCE PARAMETERS OF THE HYDROSTATIC EXTRUSION OF ALUMINIUM ALLOYS
A. I. Kolpashnikov, I. P. Tsipulin, T. A. Mikhin, and V. A. Vyalov May 1972 9 p refs Transl. into ENGLISH from Tekhnol. Legkikh Splavov, Nauchno-Tekhn. Byul. VILSA (USSR), no. 1, 1970 p 31-34
(NLL-RTS-7127) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.80; 3 NLL photocopy coupons

It is shown that the extruding pressure is related to the length of the tapered part of the blank and the depth of the forming band in the die. The effect of die taper and the degree of deformation on the metal extrusion pressure was studied.
Author

N72-26373 National Lending Library for Science and Technology, Boston Spa (England).
RESEARCH INTO THE POSSIBILITY OF SINTERING TUNGSTEN BORIDES TO NICKEL
S. S. Kiparisov, O. A. Nikiforov, and Yu. K. Kuzmina May 1972 7 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Tsvetn. Met. (USSR), no. 5, 1970 p 93-95
(NLL-RTS-7202) Avail: Natl. Lending Library, Boston Spa, Engl.: £ 0.60; 2 NLL photocopy coupons

The wetting of tungsten borides W2B, WB, and W2B5 with molten nickel was investigated, as well as the conditions under which dense powdered metal substances can be produced, based on data obtained from these borides and varying amounts of nickel. The angle of wetting was determined by melting nickel on a plate of tungsten boride. The interaction between tungsten borides and nickel, with low contact angles of wetting, indicates that satisfactory bonding can be anticipated during the sintering of powdered metal alloys.
K.P.D.

N72-26374 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF CAST STEEL LARGE SIZE PARTS
L. X. Nepomuceno and M. F. Barbosa 15 Mar. 1972 8 p In PORTUGUESE; ENGLISH summary
(TR-7203.571) Avail: Issuing Activity

The results of ultrasonic inspection of four steel castings are presented. Schematics, and photographs of the echograms showing the locations of the defects are included.
Transl. by F.O.S.

N72-26375*# Mechanical Technology, Inc., Latham, N.Y.
ANALYSIS OF OIL LUBRICATED, FLUID FILM, THRUST BEARINGS WITH ALLOWANCE FOR TEMPERATURE DEPENDENT VISCOSITY
C. H. T. Pan and S. B. Malanoski Washington NASA May 1972 90 p refs
(Contract NAS3-14399)
(NASA-CR-2052; MTI-71TR32) Avail: NTIS HC $3.00 CSCL 13I

A preliminary design study was performed to seek a fluid-film thrust bearing design intended to be part of a high-speed, hybrid (rolling element/fluid film) bearing configuration. The base line used is a design previously tested. To improve the accuracy of theoretical predictions of load capacity, flow rate, and friction power loss, an analytical procedure was developed to include curvature effects inherent in thrust bearings and to allow for the temperature rise in the fluid due to viscous heating. Also, a narrow-groove approximation in the treatment of the temperature field was formulated to apply the procedure to the Whipple thrust bearing. A comparative trade-off study was carried out assuming isothermal films; its results showed the shrouded-step design to be superior to the Whipple design for the intended application. An extensive parametric study was performed, employing isoviscous calculations, to determine the optimized design, which was subsequently recalculated allowing for temperature effects.
Author

N72-26376*# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
INTEGRATION OF NASA-SPONSORED STUDIES ON ALUMINUM WELDING
Koichi Masubuchi Washington NASA Jun. 1972 321 p refs
(Contract NAS8-24364)
(NASA-CR-2064) Avail: NTIS HC $6.00 CSCL 13H

The results are presented of numerous studies relating to aluminum alloy welding. The subjects covered include: (1) effects of porosity on weld joint performance, (2) sources of porosity, (3) weld thermal effects, (4) residual stresses and distortion, and (5) manufacturing process system control.
Author

N72-26377*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SIXTH AEROSPACE MECHANISMS SYMPOSIUM
George G. Herzl, ed. Washington Jun. 1972 150 p refs Held at Moffett Field, Calif., 9-10 Sep. 1971
(NASA-TM-X-2557; A-4047) Avail: NTIS HC $3.00 CSCL 22B

Both successes and failures are presented in the design and development of mechanisms for spacecraft. Emphasis is given to aerospace mechanisms which were either flight-qualified or flight-demonstrated. For individual titles, see N72-26378 through N72-26398.

N72-26378*# Hughes Aircraft Co., Culver City, Calif.
EVALUATION OF MECHANISMS RETURNED FROM SURVEYOR 3
John R. Jones, William J. Quinn, and Karl G. Bingemann, Jr. *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 1-8 refs Prepared for JPL (See N72-26377 17-15)
(Contracts NAS9-10492; JPL-952792)
Avail: NTIS HC $3.00 CSCL 22B

The mechanisms of the TV camera and surface sampler retrieved from the Surveyor 3 spacecraft during the Apollo 12 mission are discussed. Data are presented showing the performance of these mechanisms before and after operation for one lunar day and storage for 2-1/2 years on the surface of the moon. An analysis of the critical component materials is also given.
Author

N72-26379*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SPACE QUALIFIED RADIATION SOURCE HOLDER
Louis J. Polaski and Harry R. Zabower *In its* 6th Aerospace Mech. Symp. Jun. 1972 p 9-12 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 22B

A radiation source holder was developed to permit controlled exposure of biological material to a gamma-emitting radiation source during flight in a recoverable earth-orbiting satellite. A unique spring drive mechanism, activated by real time commands from the ground station, moved the Sr-85 source from a shielded position to the exposed position and then back to the shielded condition before reentry and recovery. A fail-safe feature utilized the reentry deceleration force to ensure that the source would be in a shielded position during the recovery operations. The device was successfully flown on Biosatellite 2.
Author

N72-26380*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SPHERE LAUNCHER
Wilbur B. Reed *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 13-19 (See N72-26377 17-15)
(Contract N00030-68-C-0303)
Avail: NTIS HC $3.00 CSCL 22B

The sphere launcher was designed to eject a 200 lb, 15 in. diameter sphere from a space vehicle or missile, at a velocity of 58 ft/sec without imparting excessive lateral loads to the vehicle. This launching is accomplished with the vehicle operating in vacuum conditions and under a 9 g acceleration. Two principal elements are used: a high thrust, short burn time rocket motor and two snubbers for reducing the lateral loads to acceptable limits. Author

N72-26381*# TRW Systems Group, Redondo Beach, Calif.
PIONEER F/G FEED MOVEMENT MECHANISM
R. M. Acker *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 21-26 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 22B

The Pioneer F/G spacecraft achieves the desired earth-pointing direction through a system requiring the shifting of the main antenna feed 1 in. off axis. The feed is pivoted to this position by an electrically heated thermal actuator consisting of an electroless nickel bellows in a copper housing and filled with Freon 21. The actuator overtravels and maintains the feed in the offset position in a thermostatic limit cycle operation mode until commanded off. The mechanism is expected to operate in a -240 F environment near Jupiter and was successfully tested at such temperatures. Author

N72-26382*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
TEXTILE MECHANICAL ELEMENTS IN AEROSPACE VEHICLE PARACHUTE SYSTEMS c18
Matts J. Lindgren and Kenneth E. French *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 27-32 refs (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 11D

Materials, design considerations, and design details for textile mechanical elements used in aerospace vehicle parachute systems are briefly reviewed. Friction burns are noted as a major cause of parachute system failures. The friction burn hazard can be minimized by designing for predeployment and deployment sequence control with textile mechanical restraints. Two basic restraint designs (restraint loops and line ties) are discussed and various applications of the designs shown. Author

N72-26383*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAT PIPES FOR SPACECRAFT TEMPERATURE CONTROL: THEIR USEFULNESS AND LIMITATIONS c33
S. Ollendorf and E. Stipandic *In its* 6th Aerospace Mech. Symp. Jun. 1972 p 33-41 refs (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 20M

Heat pipes are used in spacecraft to equalize the temperature of structures and maintain temperature control of electronic components. Information is provided for a designer on: (1) a typical mounting technique, (2) choices available in wick geometries and fluids, (3) tests involved in flight-qualifying the design, and (4) heat pipe limitations. An evaluation of several heat pipe designs showed that the behavior of heat pipes at room temperature does not necessarily correlate with the classic equations used to predict their performance. They are sensitive to such parameters as temperature, fluid inventory, orientation, and noncondensable gases. Author

N72-26384*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
NEUTER DOCKING MECHANISM STUDY c31
James C. Jones *In its* 6th Aerospace Mech. Symp. Jun. 1972 p 43-49 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 22B

Neuter (or androgynous) docking systems that allow space vehicles with similar or identical docking hardware to dock are discussed. Basic requirements applicable to docking mechanism design, four neuter concepts that were studied, and the concept selected by the NASA Manned Spacecraft Center for detailed investigation are presented. Author

N72-26385*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ROCKET NOZZLE AUTOMATIC RELEASE SYSTEM
John B. Kimball *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 51-55 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 22B

The function of the mechanism described is to automatically jettison a rocket nozzle element at the conclusion of boost in order to achieve a cruise mode nozzle configuration for the balance of powered flight. The boost nozzle is retained by latched pistons that are mechanically secured until released by chamber pressure, which simultaneously assumes retention of the nozzle by holding the primary piston in place. Upon attainment of cruise mode, the chamber pressure drops, allowing springs to overcome the primary piston force and pull the keeper ring forward to free the nozzle for jettison by motor exhaust. Author

N72-26386*# TRW Systems Group, Redondo Beach, Calif.
PIONEER F/G APPENDAGE DEPLOYMENT c31
G. V. Hesprich *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 57-63 (See N72-26377 17-15)
(Contract NAS2-5600)
Avail: NTIS HC $3.00 CSCL 22B

An integrated program of testing and analysis is described for developing and flight-qualifying the appendage deployment systems of Pioneer F/G, a spin-stabilized spacecraft which will fly by Jupiter. A combination of deployment system component tests, simplified nonspinning deployment tests, and analyses were used to develop the deployment system hardware. Analytical deployment models, verified by correlation with deployment test performance data and incorporating measured system parameters, were used to project in-flight deployment system performance over the expected range of environmental and hardware extremes. Author

N72-26387*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
RADAR AUGMENTATION DEVICE c07
John K. Riedel *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 65-72 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 17I

The radar augmentation device (RAD) serves to increase the radar response of a target body and thus expedite radar acquisition. The design and development of the RAD are discussed with particular emphasis on technical problems that were encountered and solved. Discussions of the mode of operation of the RAD and the ground test history are also included. Author

N72-26388*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR ROCK SPLITTER/CAN SEALER
Kenneth G. Johnson *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 73-79 (See N72-26377 17-15)
(Contract NAS7-100)
Avail: NTIS HC $3.00 CSCL 13I

A manually powered and operated force generating device fractures lunar material as received from the moon and seals cans containing lunar samples. The rock splitting and can sealing operations are carried out in a vacuum environment. Can sealing is a cold welding process that requires a pressure of 125,000 psi (generating 32,000 lb for the largest can used). The design and modification of the device and the operating experience are described. Author

N72-26389*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA-ARC 36 INCH AIRBORNE INFRARED TELESCOPE c14
R. E. Mobley and R. M. Cameron *In its* 6th Aerospace Mech. Symp. Jun. 1972 p 81-88 refs (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 20F

A 36 in. aperture telescope is being developed for installation aboard a NASA-Lockheed C-141A aircraft. This airborne observatory will permit observation of infrared emission at altitudes above 45,000 ft above much of the infrared-absorbing atmospheric water vapor. The telescope will look through a movable open port in the aircraft fuselage. A porous spoiler, upstream from the open port, will attenuate pressure disturbances and permit operation at ambient temperatures and pressures without an obscuring window. The telescope's entire structure is supported by a 16 in. spherical air bearing, which effectively isolates it from angular aircraft motions. This air bearing support, with inertial stabilization and star tracking, will permit net line of sight stability of better than 2 arcsec rms. Author

N72-26390*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GODDARD HELICAL TAPE RECORDER c07
Frank T. Martin and Dennis K. McCarthy *In its* 6th Aerospace Mech. Symp. Jun. 1972 p 89-93 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 14C

A spacecraft recorder was developed with the objective of functioning continuously for 5 years. The resulting design employed a metallic tape wound in a 200-turn helix. A direct drive, brushless dc torquer and servo speed control drove the recorder at 3 rpm for recording and 54 rpm for playback. Author

N72-26391*# Beckman Instruments, Inc., Fullerton, Calif.
SHUTTER MECHANISM FOR SPACECRAFT SPECTROPHOTOMETER c14
August Weilbach *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 95-100 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 14B

A shutter mechanism is described for the backscatter ultraviolet spectrophotometer experiment on the Nimbus D satellite. The purpose of the experiment is to determine spatial distribution of atmospheric ozone from measurements of ultraviolet radiation backscattered by the earth's atmosphere. The system consists of two independent, rotary cylinder shutters, controlled by a dual star Geneva mechanism, and driven by a single stepper motor. A single driver controls a combination of two independently driven Geneva stars. Design considerations involved the use of low friction, nonmetallic materials. Author

N72-26392*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GAS-POWERED REENTRY BODY ERECTION MECHANISM c31
Ralph J. Muraca and Kenneth D. Hedgepeth *In its* 6th Aerospace Mech. Symp. Jun. 1972 p 101-107 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 22B

The design, analysis, testing, and flight of the supersonic planetary entry decelerator 2 spacecraft are described. The vehicle was launched in a folded condition and deployed to its required configuration following exit from the atmosphere. This concept was selected primarily because it allows utilization of existing launch vehicle systems in the most economical manner possible. Author

N72-26393*# Hughes Aircraft Co., El Segundo, Calif.
THE INTELSAT 4 ANTENNA POSITIONER c07
Frank A. Glassow *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 109-116 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 09A

The Intelsat 4 communications satellite has two spot beam antennas which are pointed to selected land masses by gimbaled positioners. The positioners employ drive motors with electromagnetic brakes and jackscrews that are self-caging during the launch. The positioner uses dry lubricants for ball bearings, spur gears, screw and nut, and various journal bearings. A coefficient of friction of approximately 0.05 was demonstrated in vacuum operation. Success of the positioner was demonstrated on the first Intelsat 4 placed in orbit in January 1971. The developmental problems that were encountered and their solutions are discussed. Author

N72-26394*# Ball Bros. Research Corp., Boulder, Colo.
ANTENNA DRIVE SYSTEM FOR THE NIMBUS SATELLITE c07
G. J. Wedlake and J. D. Loudon *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 117-120 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 09A

A two-axis drive system is described for pointing a high gain antenna. Motion about each axis is provided by identical drive mechanisms. Only three gear passes are required to obtain the necessary 900:1 gear reduction. The drive system is a primary element of an experiment that will provide a real time data link between Nimbus and ground stations. Data are transmitted from Nimbus to the applications technology satellite, which relays the data to ground stations. Author

N72-26395*# Sperry Rand Corp., Phoenix, Ariz.
A TORQUE BALANCE CONTROL MOMENT GYROSCOPE ASSEMBLY FOR ASTRONAUT MANEUVERING c21
David C. Cunningham and Glen W. Driskill *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 121-126 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 06K

A control moment gyroscope assembly is described for use in an astronaut maneuvering research vehicle. This vehicle (backpack) will be used by astronauts inside the orbiting Skylab for evaluation of various maneuvering systems. Author

N72-26396*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
A SOLID STATE FILM TRANSPORT
Charles M. Davis and Donald B. Learish (AFAL) *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 127-133 refs (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 13I

A solid state film transport utilizing piezoelectric motion was evaluated and found to have potential in film positioning applications. The concept is particularly useful in flight equipment where torque motors and conventional transport mechanisms are difficult to apply. A demonstration model utilizing 5-inch film was designed, tested, and evaluated. Three basic operating modes were investigated. Design goals for step size were achieved under controlled conditions. The continuous mode test results were marred by an inability to transfer efficiently the piezoceramic motion to the film itself. The design, test results, and problem areas are described. Author

N72-26397*# TRW Systems Group, Redondo Beach, Calif.
A PASSIVE PENDULUM WOBBLE DAMPER FOR A LOW SPIN RATE JUPITER FLYBY SPACECRAFT c21
Randall C. Fowler *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 135-141 refs (See N72-26377 17-15)
(Contract NAS2-5600)
Avail: NTIS HC $3.00 CSCL 22B

When the spacecraft has a low spin rate and precise pointing requirements, the wobble angle must be damped in a time period equivalent to a very few wobble cycles. The design, analysis, and test of a passive pendulum wobble damper are described. Author

N72-26398*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DOCKING DEVICES FOR SOYUZ-TYPE SPACECRAFT c31
V. S. Syromyatnikov *In its* 6th Aerospace Mech. Symp. Jun. 1972 p 143-150 ref (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 22B

Two docking device designs for Soyuz-type spacecraft are compared. The first was flight tested successfully; the second achieves rigid and exact joining of two spacecraft, while incorporating changes to allow for the intravehicular transfer of crew members. The main functions of the docking device are considered, with the means by which they are accomplished, and measures for increasing its reliability and flexibility in service are noted. Author

N72-26399*# Westinghouse Electric Corp., Bloomfield, N.J. Lamp Divisions.
DEVELOPMENT OF WIRE DRAWING PROCESSES FOR REFRACTORY METAL FIBERS
G. W. King Jan. 1972 69 p refs
(Contract NAS3-13216)
(NASA-CR-120925) Avail: NTIS HC $5.50 CSCL 13H

Fabrication schedules were developed for producing wire, 0.25 mm to 0.51 mm diameter, from the refractory metal alloys ASTAR-811C, B-88 and W-Hf-C. Tensile properties were evaluated at room temperature and up to 1204 C. Also, the stress rupture properties of the alloys at 1093 C were determined. W-Hf-C and B-88 were found to have the best mechanical properties on a strength to density basis. The fabrication schedules for producing wire from these two alloys were further improved with regards to the wire quality and material yield under the optimization of fabrication schedule. Author

N72-26400*# Pyronetics, Inc., Santa Fe Springs, Calif.
VALVE, NORMALLY CLOSED, TITANIUM PYRONETICS MODEL 1426 Final Report
Edward Avalos 2 Mar. 1972 49 p Prepared for JPL
(JPL-ES-565923)
(NASA-CR-127071; QC/R-6-051) Avail: NTIS HC $4.50 CSCL 13K

Performance tests of the explosive actuated, normally closed titanium valve 1426, are outlined. The valves are used to control hydrazine flow in a monopropellant thruster. Data cover pressure tests, internal and external leakage tests, flow control tests, and actuator tests. No failures were noted in any of the tests. E.H.W.

N72-26401*# Scientific Translation Service, Santa Barbara, Calif.
HIGH SPEED RADIAL THRUST MULTIPOINT BALL BEARING DESIGN
M. I. Kuruchin Washington NASA Jun. 1972 58 p refs Transl. into ENGLISH from Prochnost Din. Aviats. Dvigatei (USSR), no. 6, 1971 p 222-260
(NASA-TT-F-14304) Avail: NTIS HC $5.00 CSCL 13I

Design characteristics of high speed radial thrust ball bearings with two, three and four points of contact are discussed. Procedures are given for determining the contact resistance of a ball bearing to spinning, rolling and sliding forces. Expressions are derived to determine the motion of a ball in a radial-thrust ball bearing. Also determined are the effects of the angular deflection of the ring and of the centrifugal force on the balls on the performance of a ball bearing, on the strength of the separator in the event of a misaligned ring, and on the service life of these ball bearings. Author

N72-26402# Central Electricity Generating Board, London (England).
QUALITY PROGRAMME MANAGEMENT: A SELECTIVE BIBLIOGRAPHY, 1962 - 1971
P. G. Williams, comp. Mar. 1972 13 p refs
(CE-Bib-221) Avail: NTIS HC $3.00

Quality engineering practice is reviewed with respect to significant characteristics of mission critical components. Methods of control are described that include integrity checks at progressive assembly stages. Typical control documents are included. Author

N72-26403# Joint Publications Research Service, Arlington, Va.
QUALITY CONTROL SYSTEM FOR PRODUCTION OF MAGNETIC ANGULAR CONVERTER
L. K. Safronov and V. S. Ivanov 12 Jun. 1972 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 15, no. 3, 1972 p 70-74
(JPRS-56235) Avail: NTIS HC $3.00

A proposal is presented for a method of monitoring a magnetic angular converter by means of a printout system. The procedure is given for evaluating the production precision of the converter. Author

N72-26404# Joint Publications Research Service, Arlington, Va.
STATE OF THE ART AND PROSPECTS FOR THE DEVELOPMENT OF QUANTUM FREQUENCY STANDARDS
A. S. Bashkin 9 Jun. 1972 33 p refs Transl. into ENGLISH from Kvantovaya Elektron. (Kiev), no. 5, 1971 p 3-27
(JPRS-56220) Avail: NTIS HC $3.75

A study was conducted on the state of the art of the development of quantum frequency standards. Results are systematized and compared and advantages and deficiencies of the basic areas of creation of quantum frequency standards in the microwave and optical wave bands are noted. Author

N72-26405# Joint Publications Research Service, Arlington, Va.
ON THE STATE OF AND PROSPECTS FOR DESIGNING AUTOMATED SYSTEMS OF CONTROL FOR INDUSTRIAL ENTERPRISES
P. P. Fedorenko 6 Jun. 1972 15 p Transl. into ENGLISH from Ekonomika i Mat. Metody (Moscow), no. 2, Mar. - Apr. 1972 p 166-174
(JPRS-56178) Avail: NTIS HC $3.00

Proposals made at conferences on automated systems of control are considered. The designing, introduction, and improving of automated systems of control are discussed and problems facing researchers in the field are listed. Author

N72-26406*# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
METHODS OF MEASUREMENT FOR SEMICONDUCTOR MATERIALS, PROCESS CONTROL, AND DEVICES Quarterly Report, 1 Oct. - 31 Dec. 1971
W. Murray Bullis, ed. Jun. 1972 79 p refs Sponsored in part by Def. Nucl. Agency, Naval Strategic Systems Proj. Office, Navy Electron. Systems Command, AFWL, AFCRL, ARPA, and AEC
(NASA Order S-70003-G)
(NASA-CR-127033; NBS-TN-727) Avail: NTIS; SOD $0.70 as C 13.46:727 CSCL 13H

Activities directed toward the development of methods of measurement for semiconductor materials, process control, and devices are described. Accomplishments include the determination of the reasons for differences in measurements of transistor delay time, identification of an energy level model for gold-doped silicon, and the finding of evidence that it does not appear to be necessary for an ultrasonic bonding tool to grip the wire and move it across the substrate metallization to make the bond. Work is continuing on measurement of resistivity of semiconductor crystals; study of gold-doped silicon; development of the infrared response technique; evaluation of wire bonds and die attachment; measurement of thermal properties of semiconductor devices, delay time, and related carrier transport properties in junction devices, and noise properties of microwave diodes; and characterization of silicon nuclear radiation detectors. Author

N72-26407*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF CARBIDE SIZE, AREA, DENSITY ON ROLLING-ELEMENT FATIGUE
James L. Chevalier and Erwin V. Zaretsky Washington Jun. 1972 25 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland, Ohio
(NASA-TN-D-6835; E-6760) Avail: NTIS HC $3.00 CSCL

13H

A carbide parameter that can be used to predict rolling element fatigue life was developed.The parameter is based on a statistical life analysis and incorporates the total number of particles per unit area, particle size, and percent carbide area. These were determined from quantimet image analyzing computer examinations of random samples selected from eight lots of material previously tested in rolling fatigue. The carbide parameter is independent of chemical composition, heat treatment, and hardening mechanism of the materials investigated. Author

N72-26408# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
SPUTTER COATING OF TITANIUM CARBIDE ON CUTTING TOOLS
George Mah, Robert J. Wright, John S. Chapin, and John E. Fuller 18 Feb. 1972 9 p refs
(Contract AT(29-1)-1106)
(RFP-1702) Avail: NTIS

A sputtering process was developed for coating tungsten carbide cutting tools with titanium carbide. The X-ray diffraction results indicate that the coating has the same stoichiometric composition as the target, and the coating has a (111) preferred orientation. Photomicrographs show the coating to be of finegrain structure. The coating has hardness values of 2400 kg/sq mm which are in agreement with the values of bulk titanium carbide. Evaluations of coated tools versus uncoated tools showed that the coating increases the effective life of the tool, reduces the tool force, and improves the surface finish. Author (NSA)

N72-26409# Army Air Mobility Research and Development Lab., Fort Eustis, Va.
WIRE-BRAIDED HOSE CHAFING TESTS Final Report
Donald R. Artis, Jr. Jan. 1972 77 p refs
(DA Proj. 1F1-62205-A-119)
(AD-738842; USAAMRDL-TR-72-1) Avail: NTIS CSCL 13/11

The report presents the results of a series of tests conducted to determine the chafing characteristics of wire-braided hoses in an Army helicopter vibration environment. The tests were conducted by vibrating wire-braided hoses against one another until they failed or reached the predetermined termination test time. Failure was defined as a loss of hydraulic fluid through a worn or punctured lining at the point of contact. Once a mean time between failure was established for the unprotected (no chafe guard) hoses, various chafing protection schemes and materials were examined for their effectiveness. Author (GRA)

N72-26410# Franklin Inst., Philadelphia, Pa.
STABILITY OF TILTING-PAD JOURNAL BEARINGS Final Report, 27 Jun. 1963 - 30 Jun. 1971
J. T. McCabe and D. D. Fuller Oct. 1971 17 p
(Contract DA-31-124-ARO(D)-147; DA Proj. 200-61102-B-33-G)
(AD-738608; F-B2131; AROD-4372:7-E) Avail: NTIS CSCL 13/9

A study was conducted to develop the technology necessary to analyze, design and apply gas lubricated tilting-pad journal bearings. Author (GRA)

N72-26411# Westinghouse Electric Corp., Pittsburgh, Pa. Material Sciences Dept.
FABRICATION AND PROPERTIES OF SILICON COMPOUNDS Final Report, 1 Nov. 1970 - 31 Dec. 1971
F. F. Lange and G. R. Terwilliger 31 Jan. 1972 11 p refs
(Contract N00019-71-C-0107)
(AD-738865; Rept-72-9D2-SERAM-R1) Avail: NTIS CSCL 13/8

A study was made to accomplish the following: Investigate the relation between strength, fracture energy, and microstructure (basically, it was the purpose of this task to determine why silicon nitride is so strong relative to other ceramics); Determine the hot-pressing behavior of silicon nitride with an emphasis on the role of the additive required to densify silcon nitride powder; Study the densification of silicon nitride by the powder-vehicle hot-pressing technique and determine the limitations of this technique; Determine the dielectric properties of reaction-sintered and hot-pressed silicon nitride between 1-10 GHz. Author (GRA)

N72-26412# TRW Systems Group, Redondo Beach, Calif. Advanced Technology Staff Group.
NONDESTRUCTIVE TESTING USING TRW ACOUSTICAL IMAGING SYSTEM Semiannual Report, 30 Jun. 1970 - 1 Jul. 1971
Robert Aprahamian, Jerold L Jacoby, and Pravin G. Bhuta Aug. 1971 51 p refs
(Contract DAAG46-70-C-0103; ARPA Order 1245)
(AD-738564; AMMRC-CR-71-4/2) Avail: NTIS CSCL 14/2

The technique of Acousto-Optical Imaging (AOI) enables one to see, on a real-time basis, within optically opaque materials and to detect internal or surface flaws and/or other irregularities which might be present. The process uses an ultrasonic beam to probe the object under study. As it interacts with the object, the ultrasonic beam acquires an acoustical picture of the object. The acoustic waves then interact with a monochromatic light beam (as from a laser). Optical sidebands are produced by the Bragg diffraction of light. The cumulative result of this process is that these sidebands produce a visual image of the interior of the object. The report discusses the results of an analytical and experimental study to evaluate the applicability of acousto-optical imaging to nondestructive testing. GRA

N72-26413# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
PHASE 1 DATA REDUCTION FOR A SINGLE STAGE RESEARCH COMPRESSOR Final Report
George R. Frost Nov. 1971 109 p refs
(AD-738658; ARL-71-0253) Avail: NTIS CSCL 13/7

The report presents a computer program which reduces raw experimental data from a single stage research compressor. Input data is presumed to be digital, and recorded sequentially on magnetic tape or other suitable means. Output data is presented in a form appropriate for subsequent detailed analysis with a streamline curvature or other aerodynamic computing procedure. The program logic and the calculation procedure employed are described in detail, and its use and implementation on a computing system are explained. GRA

N72-26414# Rensselaer Polytechnic Inst., Troy, N.Y.
PROCEEDINGS OF THE 16TH MEETING OF THE MECHANICAL FAILURES PREVENTION GROUP
W. T. Sawyer 1 Feb. 1972 74 p refs Conf. held at Gaithersburg, Md., 2-4 Nov. 1971
(Contract N00014-67-A-0117)
(AD-738855; MFPG-9) Avail: NTIS CSCL 11/8

The report concerns three-day discussions by a group of nationally-recognized specialists of the subject "Mechanical Failure Prevention Through Lube Oil Analysis." Summaries are presented of twelve prepared talks and two panels which had as their objective the examination of the state of the art in the use of lube oil analysis with regard to both stationary installations and on-line systems. Limitations and gaps in the technology available for problem solving are identified, providing guidance for future research. Reports of problems encountered in current field service provide an estimate of the magnitude of the problem and the relevance of current research. Significant audience discussions are reported. Author (GRA)

N72-26415# Harry Diamond Labs., Washington, D.C.
FLUERICS 30: THE MATCHED ACOUSTIC GENERATOR
Kenji Toda, Gary L. Roffman, and Albert I. Talkin Dec. 1971 21 p refs

(DA Proj. 1T0-61102-A-33-B)
(AD-738793; HDL-TR-1574) Avail: NTIS CSCL 13/7

A swept-frequency, matched acoustic generator for quickly measuring the insertion power gain and bandwidth of flueric components was developed and tested. The generator produces and measures the signal incident on flueric elements unaffected by their reflections. The components are connected to the generator by transmission lines. The output of the flueric unit is measured in a line of the same diameter as the input line and long enough to attenuate reflections from the far end of the line to negligible levels. Author (GRA)

N72-26416# IIT Research Inst., Chicago, Ill.
OPERATION OF RELIABILITY ANALYSIS CENTER Final Report, 15 Sep. 1970 - 30 Sep. 1971
Harold Lauffenburger, Hugh Edfors, and Barbara Petersen Griffiss AFB, N.Y. RADC Jan. 1972 109 p
(Contract F30602-71-C-0164)
(AD-738649; IITRI-FR-E6184; RADC-TR-71-304) Avail: NTIS CSCL 09/2

The Reliability Analysis Center is a service for the dissemination of reliability test and experience information on microcircuit devices. This report summarizes accomplishments of the Center during its third full year of operation, covering the period from 1 September 1970 through 30 September 1971. Information is presented on the output products and services, input data acquisitions, and the internal information processing functions. In addition, subscriber status and individual publication sales are documented. The various methods for publicizing RAC services and current efforts directed toward expansion of these services to effect greater utilization of accumulated data resources are discussed. Author (GRA)

N72-26417# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
ON CRACKS IN WELDS AND WELDED STRUCTURES
Lambert Tall May 1971 38 p refs
(Contract N00014-68-A-0514)
(AD-738447; FEL-358.30) Avail: NTIS CSCL 13/5

The paper summarizes some findings on cracks in welded structures made during various research studies - in particular, certain aspects of a major long-term research program on low-cycle fatigue are included. Author (GRA)

N72-26878 Kaman Sciences Corp., Colorado Springs, Colo.
DEVELOPMENT OF A LIGHTWEIGHT, LINEAR MECHANICAL SPRING ELEMENT
R. E. Keeffe *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 179-185 refs (See N72-26860 17-32)
(Contract DAAH01-69-C-1809)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C., HC $4.00 per set

N72-26885 Admiralty Surface Weapons Establishment, Portsmouth (England).
SHOCK MOUNTING SYSTEM FOR ELECTRONIC CABINETS
W. D. Delany *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 15-20 (See N72-26882 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26895 Florida Univ., Gainesville. Dept. of Engineering.
DYNAMIC ANALYSIS OF THE RUNAWAY ESCAPEMENT MECHANISM
Gene W. Hemp *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 125-133 refs (See N72-26882 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N72-26418 National Lending Library for Science and Technology, Boston Spa (England).
ON THE POSSIBILITY OF PRODUCING A CO2 LASER WITH A PUMPED ELECTRON BEAM
G. G. Dolgov-Savelev et al 30 Mar. 1972 6 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (USSR), v. 12, no. 4, 1970 p 737-739
(NLL-DRIC-Trans-2710-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL Photocopy coupon

A carbon dioxide pulsed laser was used for the case when an electron beam with energy about equal to 0.5 MeV is introduced across the discharge interval. Generation in carbon dioxide was studied close to threshold. The influence of the electron beam on the discharge parameters was also investigated. It is postulated that the introduction of an electron beam into the discharge area, despite the insignificant energy investment, essentially changes the function of electron distribution by energy and leads to a noticeable increase in output power of the laser. This appears particularly marked in a mixture of carbon dioxide and argon or xenon. K.P.D.

N72-26419*# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
AMPLITUDE AND POLARIZATION ASYMMETRIES IN A RING LASER
L. L. Campbell and N. E. Buholz Jan. 1971 83 p refs
(NASA-CR-127052; UTEC-MD-71-061; RC-1) Avail: NTIS HC $6.25 CSCL 17I

Asymmetric amplitude effects between the oppositely directed traveling waves in a He-Ne ring laser are analyzed both theoretically and experimentally. These effects make it possible to detect angular orientations of an inner-cavity bar with respect to the plane of the ring cavity. The amplitude asymmetries occur when a birefringent bar is placed in the three-mirror ring cavity, and an axial magnetic field is applied to the active medium. A simplified theoretical analysis is performed by using a first order perturbation theory to derive an expression for the polarization of the active medium, and a set of self-consistent equations are derived to predict threshold conditions. Polarization asymmetries between the oppositely directed waves are also predicted. Amplitude asymmetries similar in nature to those predicted at threshold occur when the laser is operating in 12-15 free-running modes, and polarization asymmetry occurs simultaneously. Author

N72-26420*# Raytheon Co., Sudbury, Mass. Equipment Div.
DEVELOPMENT OF CARBON DIOXIDE LASER DOPPLER INSTRUMENTATION DETECTION OF CLEAR AIR TURBULENCE Final Report
C. Sonnenschein, A. Jelalian, and W. Keene 5 Jun. 1970 270 p refs
(Contract NAS8-24742)
(NASA-CR-127058; ER70-4203) Avail: NTIS HC $15.50 CSCL 20E

The analytical, experimental, and developmental aspects of an airborne, pulsed, carbon dioxide laser-optical radar system are described. The laser detects clear air turbulence and performs Doppler measurements of this air-motion phenomenon. Conclusions and recommendations arising from the development of the laser system are presented. Author

N72-26421# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
QUANTITATIVE LASER SCHLIEREN MEASUREMENTS IN AN EXPANDING HYPERSONIC LAMINAR BOUNDARY

LAYER
W. W. Koziak Oct. 1971 81 p refs
(UTIAS-173) Avail: NTIS HC $6.25

The development and application of a quantitative space and time-resolved laser schlieren system to measure density gradients in a laminar hypersonic boundary layer expanding from Mach 6.5 over a 5 degree expansion corner are discussed. The experiment was undertaken to test the validity of recently developed theoretical calculations which do not omit upstream influence and centrifugal effects, transverse pressure gradients in the boundary layer, and boundary layer-expansion wave interaction. Author

N72-26422# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
LIDAR MEASUREMENTS IN THE STRATOSPHERE UP TO AN ALTITUDE OF 50 km
H. J. Katerle 20 Dec. 1971 39 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-102) Avail: NTIS HC $4.00; DFVLR Porz-Wahn: 13,30 DM

The theoretical background to lidar measurements and the equipment which was used are described. The results of the lidar measurements are discussed on the basis of the aerosol distribution at altitudes above and below 20 km. The fine structure of the lidar profiles and the observations of an extreme backscatter value from an altitude of 17 km are also discussed. Finally, the lidar profiles are compared with the results from particle collection methods at a height of 20 km. Author

N72-26423*# Jobin et Yvon S. A., Arcueil (France).
CONCAVE HOLOGRAPHIC GRATING FOR SPECTROGRAPHIC APPLICATIONS: STUDY OF THE ABERRATIONS Final Report
G. Pieuchard and J. Flamand [1972] 236 p
(Contract NASw-2146)
(NASA-CR-122430) Avail: NTIS HC $14.00 CSCL 20E

An analysis of reflecting diffraction gratings by the application of holographic techniques is presented. The subjects discussed are: (1) holographic grating properties, (2) calculation of aberrant optical path, (3) analytical expression of stigmatic points, (4) spherical aberration and limitation of grating width, and (5) determination of construction parameters. P.N.F.

N72-26424# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
LIMITS TO THE DETECTION OF SMALL INTERNAL VOIDS IN SOLIDS WITH HOLOGRAPHIC TECHNIQUES
B. J. Pernick Jun. 1972 85 p refs
(RM-543) Avail: NTIS HC $6.25

The ability to find small voids in acoustically excited solid specimens using coherent optical detection methods is limited by three factors: (1) available ultrasonic power levels, (2) acoustical and optical noise element, and (3) nonlinear properties of the working materials. Constraints on the detection sensitivity due to ultrasonic power limitations are established. A void embedded in an elastic halfspace is used as a physical model. Deformations of the free surface due to void-scattered ultrasonic waves are derived and illustrated for several void sizes and depth locations. The deformations are shown to be too small for direct optical measurement. Deflections of the free surface of a liquid layer placed on top of the elastic halfspace represent an amplified copy of the elastic boundary deformation. Properties of the liquid layer that influence the magnitude of signal amplification and sources of systematic distortions due to nonlinearities are determined from the fundamental fluid dynamic equations. Several holographic techniques to observe the liquid surface profile are discussed. These methods provide ample deflection sensitivity and noise reduction features. Author

N72-26425# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SIMPLE LINEAR-CAVITY TEM(00)-MODE MODE-LOCKED RUBY LASER
David Milam, R. A. Bradbury, and E. S. Bliss 3 Dec. 1971 11 p refs
(AF Proj. 6100)
(AD-739164; AFCRL-72-0040; AFCRL-PSRP-470) Avail: NTIS CSCL 20/5

The authors have designed a simple linear-cavity laser that is passively mode-locked, using a ruby rod only 2.5 mm in diameter and 75 mm long, and have obtained TEM(00)-mode operation. The rod itself is the limiting aperture of the field. The individual mode-locked pulses have energies of 0.2 to 0.3 mJ and are of 20 to 25 psec duration. The energy in the total pulse train is approximately 3 mJ. The probability of obtaining a cleanly locked pulse train exceeds 0.8. A further advantage inherent in the system is that the smooth beam profile minimizes the frequency of mirror damage. Author (GRA)

N72-26426# California Univ., Irvine. School of Engineering.
STUDY OF SUPERRADIANT SOURCES FOR PATH MONITORING REFERENCES IN FOURIER SPECTROSCOPY Final Report, 15 Jan. 1970 - 15 Jul. 1971
Hideya Gamo and Shih-shung Chuang 15 Aug. 1971 49 p refs
(Contract F19628-70-C-0101; AF Proj. 8603)
(AD-738655; AFCRL-71-0612) Avail: NTIS CSCL 20/5

The report discusses the properties of Xenon 3.5 micrometer superradiant radiation sources with emphasis on frequency and intensity stability, in order to determine the feasibility of their use as a path-monitoring reference for Fourier spectroscopy. Irregular intensity fluctuations due to the interaction of radiation reflected from an interferometer were eliminated by means of an infrared isolator using the Faraday rotation in Yttrium Iron Garnet. A few important aspects of superradiant radiation sources and their applications, which are desirable for future research, are described. Author (GRA)

N72-26427# Aerospace Corp., El Segundo, Calif. Lab. Operations.
RESALE 1: A CHEMICAL LASER COMPUTER PROGRAM Research Report, Jul. 1969 - Jan. 1971
George Emanuel, W. Dallas Adams, and Emily B. Turner 15 Mar. 1972 91 p refs
(Contract F04701-71-C-0172)
(AD-738647; TR-0172(2776)-1; SAMSO-TR-72-39) Avail: NTIS CSCL 20/5

The report describes the RESALE-1 computer program for calculating laser action in a chemically reacting gas. The program is applicable to either a one-dimensional steady flow or a time-dependent quiescent gas. A constant-gain method of solution is used to obtain the intensity and to account for population changes due to lasing. Vibrational populations are treated individually and thus are not in equilibrium. Rotational populations, however, are assumed to be in a Boltzmann distribution at the translational temperature. The report contains a detailed description of the formulation of the equations, the numerical methods used, and input preparation. Author (GRA)

N72-26428# Defense Documentation Center, Alexandria, Va.
MICROWAVE LASERS Report Bibliography, Jul. 1957 - Jun. 1971
Mar. 1972 266 p refs
(AD-738650; DDC-TAS-72-1) Avail: NTIS CSCL 20/5

The bibliography contains references on lasing in the microwave frequencies or masers as it is sometimes called. The references selected contain a good cross section of types of topics or studies done in this area, and are all inclusive. Some of the topics are: development of millimeter and submillimeter maser devices; photocoagulation produced by a colored light source; alkali metal optical maser, etc. Included are Corporate Author-Monitoring Agency, Subject, Title, and Personal Author Indexes. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N72-26429 National Lending Library for Science and Technology, Boston Spa (England).
OBSERVATIONS OF INTERGRANULAR SEGREGATION PHENOMENA IN NICKEL. INTRODUCTION AND PART 1
Ph.D. Thesis
C. Wache 29 Feb. 1972 44 p Transl. into ENGLISH from Metaux (Corrosion-Ind.) (St.-Germain-en-Laye), no. 546, Feb. 1971 p 4768 in FRENCH and ENGLISH
(NLL-TR-746-1205(a)-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons

Some observations are reported relating in principle to commercial nickel which may exhibit thermal segregation and the appearance of a second phase and intergranular embrittlement. The mechanical properties of this type of nickel and the presence of facets on certain grain boundaries are considered. Data on the structure of grain boundaries is presented, and a summary of the principal studies on this subject is given. The test procedures used and results are shown and discussed. Author

N72-26430 National Lending Library for Science and Technology, Boston Spa (England).
OBSERVATIONS OF INTERGRANULAR SEGREGATION PHENOMENA IN NICKEL, PARTS 2 AND 3
C. Wache 29 Feb. 1972 60 p Transl. into ENGLISH from Metaux (Corrosion-Ind.) (St.-Germain-en-Laye), no. 547, Mar. 1971 p 106-119, no. 548, Apr. 1971 p 138-162 in FRENCH and ENGLISH
(NLL-TR-746-1205(b)-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 6 NLL photocopy coupons

Materials tests were carried out on nickel and iron of different origins. The tests included standard methods such as optical and electron microscopy, tensile tests, and X-ray analysis; determination of crystalline orientations using slip lines; the Kossel line method; and scanning microscopy. K.P.D.

N72-26431 National Lending Library for Science and Technology, Boston Spa (England).
OBSERVATIONS OF INTERGRANULAR SEGREGATION PHENOMENA IN NICKEL, PART 4
C. Wache 29 Feb. 1972 23 p Transl. into ENGLISH from Metaux (Corrosion-Ind.) (St.-Germain-en-Laye), no. 550, Jun. 1971 p 243-252 In FRENCH and ENGLISH
(NLL-TR-746-1205(c)-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A discussion is presented for the techniques used for determining crystal orientations and parameter measurement, and the application of such methods as ion analysis, nuclear reaction measurements, and Auger electron spectroscopy. Metallurgical results are given for segregations, the nature of segregated impurities, structure of facet boundaries, noncoherent twinning boundaries and coincidence orientations, embrittlement, internal structure of the grains, and intergranular striation. K.P.D.

N72-26432 National Lending Library for Science and Technology, Boston Spa (England).
PROPERTIES AND APPLICATIONS OF THE NITROGEN CONTAINING STEEL X 5 CrNiMoN 17 13
A. Baeumel 29 Feb. 1972 6 p Transl. into ENGLISH from Berg Huettenmaenn. Monatsh (Vienna), v. 116, 1971 p 88-94 In ENGLISH and GERMAN
(NLL-Trans.-746-1120-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Molybdenum-bearing austenitic chromium-nickel steels are considered as an example of corrosion-resistant steels. Among the topics discussed are: structural state, precipitation behavior and the influence of nitrogen, physical properties, weldability, usable steel for plant construction, special corrosion resistance and pitting, crevice and stress corrosion, resistance to mixed acids, and actual applications. K.P.D.

N72-26433*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ULTRASONIC INVESTIGATION OF THE SUPERCONDUCTING PROPERTIES OF THE Nb-Mo SYSTEM
Lewis L. Lacy Washington Jun. 1972 54 p refs
(NASA-TN-D-6828) Avail: NTIS HC $3.00 CSCL 11F

The superconducting properties of single crystals of Nb and two alloys of Nb with Mo were investigated by ultrasonic techniques. The results of measurements of the ultrasonic attenuation and velocities as a function of temperature, Mo composition, crystallographic direction, and ultrasonic frequency are reported. The attenuation and small velocity changes associated with the superconductivity of the samples are shown to be dependent on the sample resistivity ratio which varied from 4.3 for Nb-9% Mo to 6500 for pure Nb. The ultrasonic attenuation data are analyzed in terms of the superconducting energy gap term of the BCS theory. A new model is proposed for the analysis of ultrasonic attenuation in pure superconductors with two partially decoupled energy bands. To analyze the attenuation in pure superconducting Nb, the existence of two energy gaps was assumed to be associated with the two partially decoupled energy bands. One of the gaps was found to have the normal BCS value of 3.4 and the other gap was found to have the anamalously large value of 10. No experimental evidence was found to suggest that the second energy gap had a different transition temperature. The interpretation of the results for the Nb-Mo alloys is shown to be complicated by the possible existence of a second superconducting phase in Nb-Mo alloys with a transition temperature of 0.35 of the transition temperature of the first phase. The elastic constants of Nb and Nb-Mo alloys are shown to be approximately independent of Mo composition to nine atomic percent Mo. These results do not agree with the current microscopic theory of transition temperature for the transition elements. Author

N72-26434*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE 1200 C CYCLIC OXIDATION BEHAVIOR OF TWO NICKEL-ALUMINUM ALLOYS (Ni3Al AND NiAl) WITH ADDITIONS OF CHROMIUM, SILICON, AND TITANIUM
Carl E. Lowell and Gilbert J. Santoro Washington Jun. 1972 18 p refs
(NASA-TN-D-6838; E-6752) Avail: NTIS HC $3.00 CSCL 11F

The alloys Ni3Al and NiAl with and without 1 and 3 atomic percent chromium, silicon, and titanium replacing the aluminum were cyclically oxidized at 1200 C for times to 200 hours, and the results were compared with those obtained with the alloy B-1900 subjected to the same oxidation process. The evaluation was based on metal recession, specific weight change, metallography, electron microprobe analysis, and X-ray diffraction. The oxidation resistance of Ni3Al was improved by Si, unaffected by Ti, and degraded by Cr. The oxidation resistance of NiAl was slightly improved by Ti, unaffected by Si, and degraded by Cr. The oxidation resistance of Ni3Al with 1 atomic percent Si was nearly equal to that of NiAl. Alloy B-1900 exhibited oxidation resistance comparable to that of Ni3Al + Cr compositions. Author

N72-26435*# Lehigh Univ., Bethlehem, Pa.
THE INFLUENCE OF TEMPERATURE ON FATIGUE-CRACK GROWTH IN A MILL ANNEALED Ti-6Al-4V ALLOY
R. P. Wei and D. L. Ritter [1972] 71 p refs
(Grant NGL-39-007-040)
(NASA-CR-127042) Avail: NTIS HC $5.75 CSCL 11D

To understand the influence temperature on the rate of fatigue crack growth in high strength metal alloys, constant load amplitude, fatigue crack growth experiments were carried out using a 1/4-inch-thick (6.35 mm) mill annealed Ti-6Al-4V alloy plate as a model material. The rates of fatigue crack growth were determined as a function of temperature, ranging from room temperature to about 290 C (or, about 550 F/563K) and as a function of the crack tip stress intensity factor in a dehumidified high purity argon environment. Limited correlative experiments indicate that dehumidified oxygen and hydrogen have no effect on the rate of fatigue crack growth in this alloy, while distilled water increased the rate of crack growth slightly in the range tested. Companion fractographic examinations suggest that the mechanisms for fatigue crack growth in the various environments are essentially the same. Author

N72-26436# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.

CREEP AND OTHER PROPERTIES OF ZINC-COPPER-TITANIUM ALLOYS ANNEALED AFTER ROLLING

Leander A. Neumeier and J. S. Risbeck 1972 35 p refs
(BM-RI-7643; LC-622.06173; TN23.U7) Avail: NTIS HC $3.75

The creep properties of Zn-Cu-Ti alloys, that were annealed after finish rolling either cold or at 480 F, are evaluated. Compositions ranged up to 1.25 pct Cu and 0.36 pct Ti. Most data are for sheet annealed after finish rolling to 92-pct total reduction. Annealing times were varied at temperatures between 320 and 560 F (160 and 293 C). For a number of the alloys, annealing after hot rolling at 480 F affects creep properties very differently in longitudinal and transverse sheet directions. The detrimental result is that the anisotropy in creep properties between the two directions can be vastly increased. Conversely, specific annealing treatments of certain heavily cold rolled alloys result in surprisingly low anisotropy in creep properties and the low anisotropy coincides with excellent creep resistance for both directions. Supplemental data are presented on tensile, hardness, and thermal expansion properties, and microstructures. Author

N72-26437# Bureau of Mines, Boulder City, Nev. Metallurgy Research Lab.

USE OF COMPOSITE DIAPHRAGMS IN THE ELECTROWINNING OF TITANIUM

Oliver Q. Leone and D. E. Couch 1972 15 p refs
(BM-RI-7648; LC-622.06173; TN23.U7) Avail: NTIS HC $3.00

Composite diaphragms were used in the investigation of electrowinning Ti from $TiCl_4$ in a fused LiCl-KCl-$TiCl_2$ electrolyte. Composite diaphragms tested were of two general classes--those consisting of two or more solid materials, and those which contained, in addition, a loose material. An electrowinning cell using a flat diaphragm is described. The maximum current density for these diaphragms was 300 amp per sq ft. Lower currents permitted longer operation times. The composite diaphragms gave electrode efficiencies that averaged approximately 60 percent, and the electrowon titanium was of good quality--some Brinell hardnesses were as low as 68. Author

N72-26438*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

THERMAL CONDUCTIVITY OF AUSTENITIC STAINLESS STEEL, SRM 735, FROM 5 TO 280 K

J. G. Hust and L. L. Sparks Apr. 1972 22 p refs
(Contract F33615-70-M-5002)
(NASA-CR-127030; NBS-SP-260-35) Avail: NTIS; SOD $0.35 as C 13.10:260-35 CSCL 11F

Thermal conductivity and electrical resistivity measurements were conducted on two lots of an austenitic stainless steel. Electrical resistivity measurements were performed on the second lot, both before and after the material was hot-swaged and reannealed to a size 1/10 the original diameter. These measurements indicate that this steel can be swaged and reannealed without an appreciable change in thermal conductivity. Electrical resistivity measurements as well as direct thermal conductivity measurements on several specimens from both lots indicate a material variability in these lots of less than 1% in thermal conductivity. Author

N72-26439# Joint Publications Research Service, Arlington, Va.

THERMOPLASTIC HARDENING OF MARTENSITIC STEELS AND TITANIUM ALLOYS

M. Kh. Shorshorov et al 9 Jun. 1972 139 p refs Transl. into ENGLISH from the book "Termoplasticheskoye Uprochneniye Martensitnykh Staley i Titanovykh Splavov" Moscow Science Publishing House, 1971 p 3-8, 81-151
(JPRS-56215) Avail: NTIS HC $9.00

The mechanical-thermal working of martensitic steels and metastable beta-alloys of titanium is discussed. Areas and prospects for the use of thermoplastic hardening methods of structural materials with stabilization of the structural state are examined. Author

N72-26440*# McDonnell-Douglas Co., St. Louis, Mo. Research Labs.

TESTING SUPERALLOYS AT 2000 (1367) AND 2200 F (1478 K) IN A MACH 4.6 AIRSTREAM Final Report

Donald W. Land, Ronald R. Williams, and Walter A. Rinehart Apr. 1972 46 p ref Original contains color illustrations
(Contract NAS3-14666-H)
(NASA-CR-120913; MDC-q0449) Avail: NTIS HC $4.50 CSCL 11F

Seven superalloy models were tested in a plasma arc tunnel facility. The test models were 3 in. (7.62cm) square flat surfaces (nominally 0.01 to 0.02 in. (0.0254 to 0.0508 cm) thick) held in a water-cooled wedge holder at a 60 deg (1.05 rad) angle of attack. The models were cycled 25 times (two were cycled 50 times) for 10 min each cycle in a Mach 4.6 test stream with the model leading edge temperature maintained at 2200 F (1478 K) (one at 2000 F (1367 K)). Backface temperatures were measured with four platinum-platinum 10% rhodium thermocouples and the front surface temperatures with an optical pyrometer. Four different nickel base alloy materials and one cobalt material were evaluated. Author

N72-26441*# Cyclops Corp., Bridgeville, Pa. Universal-Cyclops Specialty Steel Div.

DEVELOPMENT STUDY OF COMPOSITIONS FOR ADVANCED WROUGHT NICKEL-BASE SUPERALLOYS

William B. Kent Jan. 1972 119 p refs
(Contract NAS3-14309)
(NASA-CR-120934; U-C-R-1055) Avail: NTIS HC $8.00 CSCL 11F

Using NASA IIb as a base composition, the effects of five key elements (carbon, tungsten, tantalum, aluminum, and hafnium) on resultant properties were investigated in an effort to optimize the composition and derive new wrought high temperature alloys with improved strength characteristics. A total of nineteen compositions were melted, extruded, and rolled to bar stock using thermomechanical processing. Both full and partial solution heat treatments were developed for the compositions. Tensile properties from room temperature to 1800 deg F, stress and creep rupture properties to 1800 deg F, and thermal stability characteristics were evaluated. NASA IIb-7 exhibited the best response to the partial solution heat treatment for optimum properties up to 1200 deg F. The alloy contained 0.13C, 9.0 Cr, 9.0 Co, 2.0 Mo, 7.5 W, 10.0 Ta, 3.5 Al, 0.75 Ti, 0.02 B, 0.10 Zr, 0.50 V, 1.0 Hf, and balance nickel. Author

N72-26442# Montana State Univ., Bozeman. Dept. of Aerospace and Mechanical Engineering.

HIGH TEMPERATURE OXIDATION OF IRIDIUM Annual Progress Report

R. T. Wimber 25 Feb. 1972 25 p refs
(RLO-2228-T-1-4; APR-2) Avail: NTIS

Oxidation data were obtained for the oxidation of iridium wires at 1905 C in flowing undiluted oxygen at pressures in the range of 0.0075 to 1.316 atmospheres. Utilization of two new theoretical models, in addition to an original model, provided six instantaneous rate equations and two integrated rate equations, for which correlations with the experimental data were pursued. The correlations were not as good as the quality of the experimental data would suggest might be possible; recommendations for more effectively analyzing the oxidation process are made. Results of high-temperature measurements of the thermal expansion, emissivity, and electrical resistivity of iridium are reported. Author

N72-26443# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
REPRESENTATION OF CREEP OF METALS
E. Turan Onat and F. Fardshisheh Dec. 1971 153 p refs
(Contract AT(40-1)-4075)
(ORO-4075-1) Avail: NTIS

A critical review is presented on the subject of mathematical description of creep behavior of metals for the purposes of structural analysis. The major areas of consideration include the following: (1) creep behavior under non-steady loads and/or temperatures, (2) representation of creep by means of state variables and the associated system of differential equations, (3) integral representation of creep behavior, and (4) the analysis of structures in the presence of creep. Author

N72-26444# Israel Atomic Energy Commission, Tel Aviv.
SPECTROCHEMICAL DETERMINATION OF IMPURITIES IN METALLIC PURE AND HIGH PURITY ZINC
I. Schoenfeld and M. Steiner Oct. 1971 19 p refs
(IA-1242) Avail: AEC Depository Libraries

Those elements which are undetectable or at the limit of detection by other spectrographic techniques were determined. A sensitivity of 0.000001 ppm by weight was obtained by concentrating the impurities by vacuum sublimation of the bulk of the zinc before spectrographic analysis. The microtrace impurities remained behind in the residue, together with the spec-pure graphite powder which was added to the sample before sublimation. Mn, Tl, Ni and Sb in Zn 683 and Cu, Fe, Pb and Mn in Zn 682 were determined. Author

N72-26445# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SECONDARY HARDENING Fe-C SYSTEMS AND IN SOFT AND WEAKLY ALLOYED STEELS Ph.D. Thesis - Paris Univ., Orsay
Nada Milasin-Zivkovic Dec. 1971 184 p refs In FRENCH
(CEA-R-4278) Avail: AEC Depository Libraries

The phenomenon of secondary hardening in transition metals with a cubic centered structure is considered. Iron and certain iron alloys were studied which have an alpha structure (soft steels and weakly alloyed steels). The modifications of caisson steels during irradiation and their behavior after annealing were studied. Transl. by K.P.D.

N72-26446# Iowa State Univ. of Science and Technology, Ames.
IMPURITY DEFECT INTERACTIONS AND RADIATION HARDENING IN BCC METALS
Monroe S. Wechsler [1971] 10 p refs Presented at Intern. Conf. on Defects in Refractory Metals, Mol, Belgium, 20-22 Sep. 1971 Sponsored by AEC
(IS-2620; CONF-710905-4; Contrib-3040) Avail: NTIS

A review of research on radiation hardening in bcc metals is presented. It is noted that mechanisms of radiation-anneal hardening are not firmly established. It is felt that interstitial impurities migrate to defect clusters and strengthen them as barriers to dislocation motion. This suppresses dislocation channeling for radiation-anneal-hardened materials. NSA

N72-26447# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
ELECTROCHEMICAL AND OTHER STUDIES OF A URANIUM ALLOY EXHIBITING STRESS CORROSION CRACKING
J. S. Bullock, IV and J. B. Condon 29 Feb. 1972 97 p refs
(Contract W-7405-eng-26)
(Y-1821) Avail: NTIS

Experiments have been carried out to characterize the electrochemistry and stress-corrosion-cracking properties of a uranium-niobium-zirconium alloy. Potential variations were detected on the surface of the alloy, and anodic currents were induced in air-equilibrated moisture films on the alloy. Electrochemistry of the stress-corrosion attack was found to be similar to the electrochemistry of the metal having no oxide film. Chloride ions accelerated stress-corrosion cracking apparently because of their ability to penetrate the oxide film on this alloy. Cold-worked alloy was resistant to stress-corrosion cracking, and the stress-corrosion-cracking mechanism was unrelated to a pitting-reaction mechanism. Author (NSA)

N72-26448# Rensselaer Polytechnic Inst., Troy, N.Y.
PRECIPITATION AND DISPERSION HARDENING IN HCP ALLOYS Annual Report
Norman Stoloff 1 Mar. 1972 17 p refs
(Contract AT(11-1)-3459)
(COO-3459-1) Avail: NTIS

Developments are reported for studies on: effects of cooling rate on hydride habit planes in Hf; effects of oxygen on yield stress and fracture behavior of Hf; deformation modes in Hf; strength plateau in Hf-H alloys; and step aging of Mg-3.7% Th-0.6% Zr. The results showed that the hydride habit plane of Hf is a function of cooling rate from hydriding temperatures. Slow cooling favored a prism habit plane, while water quenching favored basal hydrides. A plateau in strength of Hf-H alloys occurred at 4.2 K, as at higher temperatures. Severe embrittlement of Hf by O was found to be a consequence of solid solution strengthening and the suppression of cross slip. Oxygen induced cleavage on both 2130 and (0001) planes. Two step aging processes in Mg-Th-Zr led to a small increase in peak yield stress, but did not have an appreciable effect on fracture behavior. NSA

N72-26449# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France). Centre d'Etudes.
X-RAY MEASUREMENT OF STRESSES ON URANIUM CONTAINING 10% MOLYBDENUM BY WEIGHT
Bernard Gentil Jan. 1972 96 p refs In FRENCH
(CEA-R-4253) Avail: AEC Depository Libraries

The quenching stresses appearing in a U-10 wt % Mo alloy were studied in order to investigate their contribution to stress corrosion. The X-ray diffraction method was used. The grain size of the alloy was too large for such a method and had to be reduced. The anisotropy of the elastic constants of the material was relatively low as shown by the calibration results obtained on a bending device. Surface stresses caused in the alloy by quenching seem to be compression stresses, therefore not responsible a priori for sensitivity to stress corrosion. Author (NSA)

N72-26450# National Aerospace Lab., Amsterdam (Netherlands).
FRACTOGRAPHY OF STRESS CORROSION IN Ti-8Al TESTED IN FATIGUE
R. J. H. Wanhill Dec. 1970 35 p refs Sponsored by the Directorate Mater. Air, RNLAF
(NLR-TR-71012-U) Avail: NTIS HC $3.75

A fractographic examination was made of unnotched aged and solution-treated Ti-8Al specimens subjected to fluctuating rension fatigue in air, 3% aqueous NaCl and methanol-HCl. Crack initiation in air and 3% NaCl probably occurred from reverses slip. Crack initiation in methanol-HCl was by intergranular dissolution. Corrosion along slip bands was observed to be a secondary process in bulk specimens, but is the main process in

thin foil stress corrosion. Cycling of the crack tips into compression-induced twinning, which modified the appearance of transgranular stress corrosion. The transition from transgranular stress corrosion to Stage 2a fatigue was well defined and was probably caused by plastic blunting of the crack tip.
Author (ESRO)

N72-26451# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MICROFRACTOGRAPHY OF FATIGUE CRACKS IN VARIOUS ALLOYS BY SCANNING ELECTRON MICROSCOPY
Georges Vidal and James Morris (Surrey Univ.) 1971 37 p refs In FRENCH; ENGLISH summary
(ONERA-NT-184) Avail: NTIS HC $4.00

The fabrication processes, heat treatments and Stereoscan scanning electron microscope studies of metals and alloys fractured in tensile fatigue tests are described. The 17 metals and alloys investigated include carbon steels, low-alloy steels, stainless steels, aluminum alloys, titanium and alloys, alloy brass, forged refractory alloys, molybdenum, and refractory alloy castings. Micrography reveals fatigue striations in most alloys except for some alloy steels and brasses, as well as the presence of cups in the final static-fracture area of forged alloys. Fatigue and static fractures in cast alloys and molybdenum display a more complex topography. It is concluded (1) The presence of local fatigue striations indicate that the sample broke under fatigue stress. (2) Cups occurring all over the fracture surfaces prove that the breakage was not caused by fatigue stress. It is also pointed out that, in some cases, there is a characteristic fatigue fracture pattern identifiable, at medium magnification, without any fatigue striations occurring. Author (ESRO)

N72-26452# Battelle Memorial Inst., Columbus, Ohio.
EFFECT OF IMPURITIES AND TEMPERATURE ON THE INTERFACIAL FREE ENERGIES AND SURFACE DIFFUSION OF REFRACTORY METALS Final Report, 1 Jan. 1969 - 1 Mar. 1972
B. C. Allen 25 Feb. 1972 65 p refs
(Contract DA-ARO(D)-31-124-G1080; DA Proj. 200-61102-B-32-D)
(AD-738599; AROD-3974:10-MC) Avail: NTIS CSCL 11/6

The average surface free energies of chromium, molybdenum, and tungsten have been measured at 0.6 to 0.8 of the absolute melting temperature by multiphase equilibrations with liquid tin or silver in tantalum-gettered argon. With grain boundary groove angles measured by interferometry and stylus profile tracing, the respective values were found. Author (GRA)

N72-26453# Minnesota Univ., Minneapolis.
ELECTRONIC STRUCTURE AND THE MECHANICAL PROPERTIES OF BCC METALS Final Technical Report, 1 Oct. 1968 - 31 Aug. 1971
Dale F. Stein 31 Aug. 1971 4 p refs
(Grant DA-ARO(D)-31-124-G1038; DA Proj. 200-61102-B-33-G)
(AD-738555; AROD-7726:1-MC) Avail: NTIS CSCL 11/6

The report presents the results of an investigation to ascertain the role of alloying elements on the brittle fracture behavior of the bcc metals, with special emphasis on iron, molybdenum, and tungsten. Author (GRA)

N72-26454# Florida Univ., Gainesville.
AN INVESTIGATION OF ROTATIONAL SLIP IN METALS Final Report, 1 May 1965 - 31 Oct. 1971
R. E. Reed-Hill 31 Oct. 1971 47 p refs
(Grants DA-ARO(D)-31-124-G645; DA-ARO(D)-31-124-71-G46; DA-ARO(D)-31-124-G987; DA-ARO(D)-31-124-G1166)
(AD-738559; AROD-5303:13-MC) Avail: NTIS CSCL 11/6

Rotational slip deformation was investigated in hexagonal and fcc metals with different stacking fault energy. Parallel work was done on the basic relationship between stress and strain, work softening in polycrystalline materials, and flow stress instability of polycrystalline aluminum alloys. Author (GRA)

N72-26455# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE STRUCTURE OF GLASSY METALLIC ALLOYS
D. E. Polk Feb. 1972 23 p refs
(Contract N00014-67-A-0298-0009; NR Proj. 032-485)
(AD-738438; TR-33) Avail: NTIS CSCL 11/6

It was found possible to produce relatively stable amorphous metallic solids from many noble or transition metal-metalloid alloys in the vicinity of 80 at.% metal. Detailed consideration is given to a proposed structural model for these glasses. The structural model focuses on the role of composition in these alloys and successfully predicts the composition range for which glasses are most readily obtained. It also agrees well with experimentally determined radial distribution functions and densities and provides an understanding of the origin of the excess entropy of mixing of these alloys in the liquid state.
Author (GRA)

N72-26456# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
FLOW OF MELT AND GLASS FORMS OF METALLIC ALLOYS
D. E. Polk and D. Turnbull Feb. 1972 20 p refs
(Contracts N00014-67-A-0298-0009; NR Proj. 032-485)
(AD-738439; TR-34) Avail: NTIS CSCL 11/6

The viscosity of a near eutectic Au-Ge-Si alloy deep within the eutectic is reported. The observed viscosity is lower than that extrapolated for pure gold at this temperature so that the addition of Si and Ge to Au lowers the viscosity at high temperatures while increasing the glass forming tendency. This behavior is ascribed to the excess entropy of mixing for the alloy. The temperature dependence of the viscosity is discussed along with the associated structural changes. Since the observed viscosity of an amorphous alloy is dependent upon the structure, strain rates which alter the structure can produce a change in the effective viscosity. Author (GRA)

N72-26457# Interand Corp., Rockville, Md.
ACOUSTICAL PROPERTIES OF MAGNETOSTRICTIVE AND METALLIC MATERIALS FOR NAVAL APPLICATIONS Final Report, 15 Oct. 1970 - 14 Oct. 1971
Kenneth E. Feith and Robert J. Taylor 10 Feb. 1972 60 p refs
(Contract N00014-71-C-0172)
(AD-738868) Avail: NTIS CSCL 11/6

The complex interaction of creep and fatigue in nickel and iron specimens was investigated through the combined application of static and high frequency vibratory stress. The development of a novel measuring technique, which utilizes Barkhausen noise as a probe to monitor changes in the microstructure of metals under dynamic conditions, provided the first real time observations of vibratory annealing, high frequency, work hardening, and plastic flow. Author (GRA)

N72-26458# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
SOME IMPORTANT CONSIDERATIONS IN THE DEVELOPMENT OF STRESS CORROSION CRACKING TEST METHODS
R. P. Wei, S. R. Novak, and D. P. Williams Oct. 1971 14 p refs
(Contract N00014-68-A-0514)
(AD-738449; FEL-358.36) Avail: NTIS CSCL 11/6

The need for recognizing certain potentially serious problems in the development of standard test methods for stress corrosion cracking studies is discussed. The importance of recognizing and satisfying the basic assumptions of the linear-elastic fracture mechanics analysis in experimentation is re-emphasized. The effects of nonsteady-state crack growth, including incubation, must be taken into account in determining the crack growth kinetics. Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N72-26459*# Translation Consultants, Ltd., Arlington, Va.
NICKEL AND COBALT PHOSPHITES
A. M. Lunyatskas Washington NASA Jun. 1972 4 p refs
Transl. into ENGLISH from Tr. Akad. Nauk Lit. SSR (USSR), Ser. B, no. 4, (43), 1965 p 97-103
(Contract NASw-2038)
(NASA-TT-F-14319) Avail: NTIS HC $3.00 CSCL 11D

When nickel or cobalt react with sodium phosphite the result is the formation of the slightly soluble compounds NiHPO3 -2H2O and CoPHO3 -2H2O. The solubility of these compounds, and their dependence on solution temperature, is determined. The presence of complexing in the systems is established. Spectrophotometric and photoelectric colorimetric methods are used to determine the relationship between the formation and strength of the complexes and the solution pH and the phosphite concentration. It is established that the molar coefficients of extinction for nickel and cobalt complexes with H2PO3(-) are 6.8 and 60.1 liters/mole - cm, respectively. It is suggested that a reduction in the solubility of phosphites at elevated temperature can be the result of the decay of nickel and cobalt complexes, not only of those with hydrophosphite HOP3(2-), but also of those with H2PO3(-) ions. Author

N72-26460*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
DEVELOPMENT OF AN EXTERNAL CERAMIC INSULATION FOR THE SPACE SHUTTLE ORBITER Final Report, 3 Feb. - 3 Nov. 1971
Richard A. Tanzilli, ed. Apr. 1972 271 p refs
(Contract NAS1-10533)
(NASA-CR-112038) Avail: NTIS HC $15.75 CSCL 11B

The development and evaluation of a family of reusable external insulation systems for use on the space shuttle orbiter is discussed. The material development and evaluation activities are described. Additional information is provided on the development of an analytical micromechanical model of the reusable insulation and the development of techniques for reducing the heat transfer. Design data on reusable insulation systems and test techniques used for design data generation are included. Author

N72-26461*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
THERMOPHYSICAL CHARACTERIZATION OF COMPOSITE MATERIALS UNDER TRANSIENT HEATING CONDITIONS
J. Roetling and J. Hanson [1972] 132 p refs
(Contract NAS1-10805)
(NASA-CR-112082) Avail: NTIS HC $8.75 CSCL 11D

Thermophysical property measurements were made under transient heating conditions on several materials being considered for use in SCOUT rocket motors. The materials included were ATJ graphite, MX 2600 silica phenolic, FM 5272 cellulose phenolic, and two carbon-carbon composites: CARBITEX 700 and RPP-4. The ATJ was included as a reference or base line material to check performance of the transient tests as it was not expected to be sensitive to heating rate. Measurements included in the program were thermal conductivity, strength, compressive stress-strain (carbon-carbon only), thermal expansion and the effective thermal expansion under partially restrained conditions. Development of this latter measurement was a major part of the program. It consisted of partially restraining the expansion of a specimen as it was heated, measuring the load and strain which occurred (together with a simultaneous modulus determination by superimposing a small cyclic load) and using these quantities to calculate what the effective thermal expansion would have to be to produce the observed stress and deformation. For materials which are sensitive to heating rate, such as reinforced phenolics, it was believed that this would provide a more realistic determination of the thermal expansion as it more nearly simulates the conditions experienced in end use. Author

N72-26462# Royal Aircraft Establishment, Farnborough (England).
TYPES AND PROPERTIES OF COATINGS FOR PROTECTION AGAINST HIGH-TEMPERATURE CORROSION WITH PARTICULAR REGARD TO APPLICATIONS IN GAS TURBINE CONSTRUCTION, PART 2
E. Gondolf and H. Wehr Jun. 1972 15 p refs Transl. into ENGLISH from Stahl Eisen (Duesseldorf), v. 91, no. 15, 1971 p 885-887
(RAE-Lib-Trans-1626-Pt-2; BR29440) Avail: NTIS HC $3.00

A review is made of the technology of corrosion resistant coatings for protecting metallic materials against oxidation, sulfidation and carburization at high temperatures. The materials and processes used for preparing chromized, aluminized, chromium-aluminium-silicon, and refractory metal coatings are descibed. Emphasis is given to the chromizing of metallic materials ranging from steels, nickel and cobalt superalloys, to molybdenum and tungsten and their alloys. The relative merits of vapor phase and pack-cementation processes are discussed in detail; reference is made to alternative coating processes. Author

N72-26463*# Rice Univ., Houston, Tex.
WALL CONTRACTION IN BLOCH WALL FILMS
David S. Bartran and Henry C. Bourne, Jr. [1972] 10 p refs
(Grants NGR-44-006-001; NSF GK-3827)
(NASA-CR-127037) Avail: NTIS HC $3.00 CSCL 11D

The phenomenon of wall contraction characterized by a peak in the velocity field relationship and a region of negative differential mobility is observed. Uniaxial magnetic thin films of various compositions and magnetic properties are studied in careful interrupted pulse experiments. The observed results agree quite well with the theory for bulk samples. Author

N72-26464*# Rice Inst., Houston, Tex.
LOW FREQUENCY CREEP IN CoNiFe FILMS
David S. Bartran, Henry C. Bourne, Jr., and L. George Chow [1972] 24 p refs
(Grants NGL-44-006-033; NSF GK-3827)
(NASA-CR-127038) Avail: NTIS HC $3.25 CSCL 11D

The results of an investigation of domain wall motion excited by slow rise-time, bipolar, hard-axis pulses in vacuum deposited CoNiFe films 1500A to 2000A thick are presented. The results are consistent with those of comparable NiFe films in spite of large differences in film properties. The present low frequency creep data together with previously published results in this and other laboratories can be accounted for by a model which requires that the wall structure change usually associated with low frequency creep be predominately a gyromagnetic process. The correctness of this model is reinforced by the observation that the wall coercive force, the planar wall mobility, and the occurrence of an abrupt wall structure change are the only properties closely correlated to the creep displacement characteristics of a planar wall in low dispersion films. Author

N72-26465# National Bureau of Standards, Washington, D.C. Heat Div.
GLASS LIMIT STANDARDS DEPOSITED AT NBS FOR RAILWAY, HIGHWAY AND AIRWAYS TRAFFIC SIGNAL COLORS: HISTORY, PERMANENCE AND COLORIMETRIC PROPERTIES Final Report
Geraldine W. Haupt Jun. 1971 121 p refs
(NBS-TN-564) Avail: SOD $1.00 as C 13.46:564

Signal glass limit standards are discussed for railway, highway, and aviation colors, selected by user-organizations, which are on deposit at the National Bureau of Standards. Permanence of the filters is examined, based on colorimetric conversions for CIE standard illuminant A derived from spectrophotometric measurements made on different instruments over periods of years. Spectral transmittance data and the resulting colorimetric data are given for 9 illuminants ranging in distribution temperature from 1500 to 3250 Kelvin and for CIE standard illuminants B and C. Figures show, for several filters of each color, the shifts occurring both in chromaticity (x,y) and in redness and brightness index (u,w*) with changes in illuminant. Author

N72-26466*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CHANGE IN TRANSMITTANCE OF FUSED SILICA AS A MEANS OF DETECTING MATERIAL SPUTTERED FROM COMPONENTS ON A 5-cm ION THRUSTER

A. J. Weigand and M. J. Mirtich May 1972 29 p refs
(NASA-TM-X-68073; E-6964) Avail: NTIS HC $3.50 CSCL 11D

Two endurance tests of a 5-cm mercury bombardment thruster are reported. Both tests used a translational screen-grid system with the beam vectored 10 degrees. The first test lasted 141 hours and the second test operated for 2026 hours. In each test two fused silica samples (solar cell covers), 2.0 cm by 2.1 cm, were placed in shielded holders to detect materials sputtered from the thruster. Spectral optical properties between 0.398 and 2.16 microns were measured on each sample, both before and after the endurance tests. The deposition on each sample was spectrographically analyzed to determine the type of materials sputtered from the thruster. It was found that sputtering from the neutralizer is highly dependent on its position with respect to the beam edge. The sputtering from the accelerator grid of the translational screen-grid system of the 2026 hour test was sufficient to form an opaque film on the sample located in the direction opposite to the vectored beam. Author

N72-26467# California Univ., Livermore. Lawrence Radiation Lab.

SMOKE DEVELOPMENT OF PLASTICS UNDER VARIOUS FIRE PARAMETERS

J. R. Gaskill 12 Nov. 1971 25 p refs Presented at the 30th Ann. Tech. Conf. of the Society of Plastic Engr., Chicago, 15-18 May 1972 Sponsored by AEC
(UCRL-73552) Avail: NTIS

Employing a modified smoke chamber, a number of plastics were exposed to combinations of fire conditions, i.e., radiant heat, the presence or absence of an igniting flame, and variable ventilation. The resulting smokes were measured as opacity-time plots, from which characteristic values were derived. Smokes were also analyzed for specific hazardous gaseous components. Author

N72-26468# Illinois Inst. of Tech., Chicago.

STRENGTHENING AND TOUGHENING OF BRITTLE MATERIALS Progress Report

L. J. Broutman, B. D. Agarwal, and P. K. Mallick 31 Jan. 1972 67 p refs
(Contract AT(11-1)-1794)
(COO-1794-10) Avail: NTIS

The influence of spherical particles on the strength and toughness of brittle materials was investigated. A finite element analysis was used to determine the internal stresses in the matrix of a spherical particle composite as a function of interparticle spacing or volume percent. The results are summarized. The mechanical properties of glass spherical particle filled polymers were studied as a function of the degree of bonding between the glass particle and matrix as well as the volume fraction of particles. It is shown that elastic constants can be predicted by the finite element analysis. Studies on the fatigue of alumina ceramics are summarized. Author

N72-26469# Central Electricity Generating Board, Berkeley (England). Research Labs.

AN ASSESSMENT OF THE METHODS AVAILABLE FOR MEASURING SCALE-METAL ADHESION AND THE MECHANICAL PROPERTIES OF OXIDES

M. R. Wootton Nov. 1971 17 p refs
(RD-B-N-2116) Avail: AEC Depository Libraries

Various methods of measuring scale-metal adhesion and the mechanical properties of oxides are discussed. Of these, only one permits the assessment of both parameters, and is also capable of measuring the mechanical properties of as-growing oxide. This method is based on measurement of the change in frequency of vibration of an oxidizing rod. Author (NSA)

N72-26470# Royal Netherlands Aircraft Factories Fokker, Amsterdam. Dept. of Manufacturing Research and Product Development.

MEASUREMENT ON THE EFFECTS OF VACUUM OR RADIATION ON POLYMERS

L. Godfried 29 Feb. 1972 39 p
(Contract ESTEC-647/69-AA)
(R-1485; TR-5) Avail: NTIS HC $4.00

The results of thermal vacuum tests at 60 and 120 C on thermosetting plastics are given for flexibility and weight loss. The plastics were Kinel M33-MOS2, Rodorsil 3066, Wacker XV 17, Araldit F/Hardener 972, Araldit F/Hardener MNA, and Araldit D/Hardener 1951. Author (ESRO)

N72-26471# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFLUENCE OF TEST TIME AND CONTACT STRESSES ON ANTIWEAR PROPERTIES OF JET FUELS UNDER ROLLING FRICTION

A. F. Aksenov and A. A. Litvinov 30 Dec. 1971 10 p refs
Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 17, 1970 p 130-133
(AF Proj. 7343)
(AD-738883; FTD-HT-23-1235-71) Avail: NTIS CSCL 11/4

An experiment investigation of the influence of various factors on the wear of jet fuels (T-1, TS-1, T-7, and T-7 with antiwear additions) was conducted using the magnitude of wear and the increment in fuel temperature as criteria for evaluating the antiwear properties of the fuels. Particular attention was given to the influence of contact stresses, the rate of rolling friction, and time. It is shown that these factors can have a substantial influence on the quantitative and qualitative relationships between friction and wear. This indicates that the antiwear properties of such fuels should be studied in the laboratory for a wide range of external effects. Author (GRA)

N72-26472# Naval Air Development Center, Johnsville, Pa. Aero Materials Dept.

CORROSION RESISTANCE OF FASTENER COATINGS Progress Report

Stanley R. Brown 11 Jan. 1972 41 p refs
(AD-738805; NADC-MA-7150) Avail: NTIS CSCL 11/3

Coating materials are needed to replace electrodeposited cadmium on steel fasteners for use in high performance aircraft. A study was made to compare corrosion resistance of ten experimental coatings, mostly aluminum-rich types, with cadmium. Several experimental coatings provided high resistance to 5% NaCl salt fog and NaCl-SO2 salt fog exposure tests. Paint adhesion was excellent on all fastener coatings with an epoxy primer/polyurethane topcoat system. Cadmium and the other fastener materials examined in this study varied widely in coating thickness on different fastener surface areas. Author (GRA)

N72-26890*# General Electric Co., Philadelphia, Pa. Space Div.

A LAYERED VISCOELASTIC EPOXY RIGID FOAM MATERIAL FOR VIBRATION CONTROL

C. V. Stahle and A. T. Tweedie *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 65-75 ref (See N72-26882 17-32)
(Contract NAS5-11320)
(NASA-CR-127027) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 11D

N72-26382*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
TEXTILE MECHANICAL ELEMENTS IN AEROSPACE VEHICLE PARACHUTE SYSTEMS
Matts J. Lindgren and Kenneth E. French *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 27-32 refs (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 11D

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N72-26473 Polytechnic Inst. of Brooklyn, N.Y.
HYPODATA: A NONPARAMETRIC CLASSIFICATION TECHNIQUE FOR MULTIMODAL DATA USING HYPERPLANES Ph.D. Thesis
Michael Barry Lipson 1971 142 p
Avail: Univ. Microfilms Order No. 71-29072

A new categorizer design algorithm called Hypodata is formulated. It generates piecewise linear boundaries that perfectly classify training samples. The algorithm is demonstrated by examples and a detailed discussion of the algorithm operation is given. The algorithm is not guaranteed to successfully terminate in all possible cases, but experience has shown that the algorithm terminates successfully in practical cases. Several linear and piecewise linear design algorithms are applied to examples and the resulting categorizer performances compared. The categorizer design algorithms evaluated are: Isodata, Henrichon and Fu, Duda and Fossum, Rosen and Hall, Highleyman, and Hypodata. The examples used to evalute the categorizer design algorithms are two-category problems; each pattern has two Gaussian distributed components. A training set of 100 labeled patterns per category is used to design the categorizers and an evaluation set of 100 labeled patterns per category is used to evaluate the categorizers. Evaluation of the categorizer performance is made versus a categorizer design parameter, when available. Dissert. Abstr.

N72-26474*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
SOME SEQUENTIAL, DISTRIBUTION-FREE PATTERN CLASSIFICATION PROCEDURES WITH APPLICATIONS
J. L. Poage Jul. 1971 172 p refs
(Grant NGL-22-007-143)
(NASA-CR-127054; TR-2) Avail: NTIS HC $10.75 CSCL 12A

Some sequential, distribution-free pattern classification techniques are presented. The decision problem to which the proposed classification methods are applied is that of discriminating between two kinds of electroencephalogram responses recorded from a human subject: spontaneous EEG and EEG driven by a stroboscopic light stimulus at the alpha frequency. The classification procedures proposed make use of the theory of order statistics. Estimates of the probabilities of misclassification are given. The procedures were tested on Gaussian samples and the EEG responses. Author

N72-26475*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUMMARY OF TRANSFORMATION EQUATIONS AND EQUATIONS OF MOTION USED IN FREE FLIGHT AND WIND TUNNEL DATA REDUCTION AND ANALYSIS
Thomas G. Gainer and Sherwood Hoffman 1972 127 p refs
(NASA-SP-3070) Avail: NTIS HC $3.00 CSCL 12A

Basic formulations for developing coordinate transformations and motion equations used with free-flight and wind-tunnel data reduction are presented. The general forms presented include axes transformations that enable transfer back and forth between any of the five axes systems that are encountered in aerodynamic analysis. Equations of motion are presented that enable calculation of motions anywhere in the vicinity of the earth. A bibliography of publications on methods of analyzing flight data is included. F.O.S.

N72-26476# Research Inst. of National Defence, Tumba (Sweden).
ALGORITHM: CALCULATION OF FOURIER INTEGRALS (D1)
Bo Einarsson Mar. 1971 4 p refs Revised
(F-138-Rev) Avail: NTIS HC $3.00

The cubic spline fit was used to calculate Fourier integrals. The obtained formulas require the values of the first and second derivatives at the boundary points. Author

N72-26477# Alabama Univ., University. Dept. of Physics.
GLOBAL STABILITY IN THE RESTRICTED THREE-BODY PROBLEM
L. D. Mullins and J. H. Bartlett 1 Jun. 1972 139 p refs
(Grant NSF GP-20122)
(TR-2) Avail: NTIS HC $9.00

A topological approach to global system stability is considered. The method was applied to the class I orbits of the restricted three-body problem for the case of equal masses of the primaries. This class is one of simple direct orbits about one primary and was chosen because prior linear analyses showed some of these orbits to be stable over a considerable range of the Jacobi constant. The analysis revealed that some of the linearly stable orbits (simple elliptic fixed points) had significant regions of global stability around them and some did not. Generally, the region of global stability increased with increasing values of the Jacobi constant. Author

N72-26478# Alabama Univ., University. Dept. of Physics.
DEPENDENCE OF THE PERIODIC-ASYMPTOTIC ORBITS IN THE RESTRICTED THREE-BODY PROBLEM ON THE MASS RATIO OF THE PRIMARIES
L. D. Mullins and J. H. Bartlett 1 Jun. 1972 40 p refs
(Grant NSF GP-20122)
(TR-3) Avail: NTIS HC $4.00

Certain limiting trajectories associated with the triangular equilibrium points were determined as a function of mass ratio of the primaries. The study began with the periodic asymptotic trajectories at equal masses of the primaries and gamma = 0. The evolution of these trajectories was investigated as gamma approached + or - gamma sub c. Difficulties encountered in following the orbits as gamma gets very close to gamma sub c are discussed. K.P.D.

N72-26479*# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
CONSTANT DIRECTIONS OF THE RICCATI EQUATION
David Rappaport Apr. 1970 35 p refs
(Grants NGL-05-018-044; AF-AFOSR-1244-67)
(NASA-CR-127035; USCAE-117; AFOSR-70-1374TR) Avail: NTIS HC $3.75 CSCL 12A

A constant direction of the Riccati equation associated with a class of singular discrete-time optimization problems is defined. The set of constant directions is completely characterized using a control viewpoint. Constant directions are used to reduce the computational complexity of the optimal system. Application to optimal filtering in colored noise is given. Author

N72-26480*# Massachusetts Inst. of Tech., Cambridge.
ON THE MINIMAX FEEDBACK CONTROL OF UNCERTAIN DYNAMIC SYSTEMS
Dimitri P. Bertsekas and Ian B. Rhodes (Wash. Univ., St. Louis) Jan. 1972 6 p refs
(Grants NGL-22-009-124; AF-AFOSR-1724-69)
(NASA-CR-127028; AD-736832; F3-3) Avail: NTIS HC $3.00 CSCL 12A

In the paper the problem of optimal feedback control of uncertain discrete-time dynamic systems is considered where the uncertain quantities do not have a stochastic description but instead are known to belong to given sets. The problem is concerted to a sequential minimax problem and dynamic programming is suggested as a general method for its solution. The notion of a sufficiently informative function, which parallels the notion of a sufficient statistic of stochastic optimal control, is introduced, and conditions under which the optimal controller decomposes into an estimator and an actuator are identified.
Author (GRA)

N72-26481# Sheffield Univ. (England). Dept. of Probability and Statistics.
CHARACTERIZATIONS OF SOME STOCHASTIC PROCESSES
D. N. Shanbhag Apr. 1972 14 p refs
(RR-109/DNS-4) Avail: NTIS HC $3.00

Some characterizations are presented for the Poisson and Wiener processes, as well as the M/G infinity queueing system. Denoting the number of events in (0,t) for a renewal process by X(t), it is established that the following properties are equivalent and characterize the Poisson process: (1) X(t) has the rth factorial moment to be a polynomial in t, and (2) X(t) has a power series distribution.
Author

N72-26482# Sheffield Univ. (England). Dept. of Probability and Statistics.
HYPERADMISSIBILITY IN SURVEY SAMPLING
J. Lanke (Lund Univ., Sweden) and M. K. Ramakrishnan Mar. 1972 14 p refs
(RR-105/JL/MKR-1) Avail: NTIS HC $3.00

The criterion of hyperadmissibility due to Hanurav is proposed for unbiased estimation of the finite population total in survey sampling. Discussed are two slightly different definitions, their interrelation and their relations to the definition of admissibility.
Author

N72-26483# Sheffield Univ. (England). Manchester-Sheffield School of Probability and Statistics.
TESTS OF MAIN EFFECTS IN HIGHER-WAY LAYOUTS IN THE ANALYSIS OF VARIANCE RANDOM EFFECTS MODEL
U. D. Naik May 1972 20 p refs
(RR-111/UDN-2) Avail: NTIS HC $3.00

Procedures are given to test the main effects in complete three way and higher way layouts in the effects model. The procedures are designed with the view that the size of the test does not exceed the preassigned level of significance. The size and the power function of the tests are investigated.
Author

N72-26484# Sheffield Univ. (England). Manchester-Sheffield School of Probability and Statistics.
A BAYESIAN ANALYSIS OF CERTAIN CONTAMINATED SAMPLES
U. D. Naik Mar. 1972 16 p refs
(RR-104/UDN-1) Avail: NTIS HC $3.00

The problem of contamination in normal and exponential samples is studied. The contamination is of the following type: Among a set of k samples, which in absence of contamination would have followed a central stochastic model, there exists an unknown number of samples following a different model. By specifying the prior probabilities of various contaminations of this type, an analysis is given using the Bayes approach.
Author

N72-26485# Los Alamos Scientific Lab., N.Mex.
MULTIGROUP MONTE CARLO AND S SUB N METHODS FOR AIR TRANSPORT
D. R. Harris, D. R. Koenig, and W. Preeg 15 Nov. 1971 20 p refs Presented at the Radiation Shielding Inform. Center Seminar Workshop, Oak Ridge, Tenn. Sponsored by AEC
(LA-DC-13269; Conf-711125-8) Avail: NTIS

A series of multigroup codes and methods are tested for neutron transport in air by comparison of calculations against Livermore time-of-flight measurements of neutrons emerging from liquid nitrogen and liquid oxygen spheres pulsed by D-T neutrons. These experiments are most readily analyzed by Monte Carlo techniques, so the analysis proceeds in two steps. First, it is established theoretically and verified by test cases, including an air transport milestone case, that the series of multigroup S sub n codes agree with the ANDY multigroup Monte Carlo code. Second, the ANDY code is used to calculate the Livermore nitrogen and oxygen experiments for various multigroup structures and scattering treatments based on the latest Young-Foster evaluations of nitrogen and oxygen cross sections. The results indicate that comparision with these pulsed sphere experiments is insensitive to group structure and scattering pattern, and that reasonable agreement can be obtained with P sub 0 transport corrected cross sections having only 10 energy groups above the detector energy bias.
Author (NSA)

N72-26486# Naval Postgraduate School, Monterey, Calif.
STATISTICAL EXTRAPOLATION M.S. Thesis
Dennis Randolph Oldson Sep. 1971 67 p refs
(AD-738919) Avail: NTIS CSCL 12/1

The mathematics of extrapolating known statistics of components to the probability density function of a system's performance measure is considered. Quadrature sum integration schemes for evaluating the resulting required integration are examined, and alternate integral approximation schemes are developed utilizing Monte Carlo methods. A simple electrical circuit example illustrates the use of these techniques.
Author (GRA)

N72-26914 Naval Civil Engineering Lab., Port Hueneme, Calif.
ON THE USE OF FOURIER TRANSFORMS OF MECHANICAL SHOCK DATA
H. A. Gaberson and D. Pal *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 87-96 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26721*# Techtran Corp., Glen Burnie, Md.
SOLUTIONS OF A HIGH ORDER SYSTEM OF ALGEBRAIC EQUATIONS OF CONDITION IN WHICH THE COEFFICIENTS, FREE TERMS, AND UNKNOWNS ARE POSITIVE NUMBERS
Yu. A. Pupyshev and L. D. Shevchenko *In its* Meteoric Propagation of Radio Waves May 1972 p 19-32 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 12A

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N72-26487 New York Univ., N.Y.
OBJECTIVE ANALYSIS OF SEA-LEVEL WINDS AND PRESSURES DERIVED FROM SIMULATED OBSERVATIONS OF A SATELLITE RADAR-RADIOMETER AND ACTUAL CONVENTIONAL DATA Ph.D. Thesis

Leonard M. Druyan 1971 83 p
Avail: Univ. Microfilms Order No. 71-29668

A computer based procedure is developed that combines a field of simulated satellite derived wind speeds with a limited amount of conventional surface data so as to recover the surface pressure field and the vector wind field over the North Pacific Ocean. Wind speeds are determined from an objective analysis of high spatial density ship observations in order to simulate the anticipated output of a proposed satellite mounted radar-radiometer system. The simulated speeds are combined with the conventional network for various spatial distributions of ship data. The average RMS departure of sea-level pressure fields analyzed by deleting from 75% to 94% of the available ship observations from the maximum data analysis is from 3.0 to 4.0 mb. Comparison of the wind components implied by the isobaric patterns to those of the withheld ship observations yields average RMS differences of from 8.7 to 9.4 knots for a range of 75% to 94% data deletion. Dissert. Abstr.

N72-26488 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.

METEOROLOGICAL DATA. VOLUME 120, NO. 12: RESULTS OF THE SYNOPTIC SERVICE DURING 1971. DAILY WEATHER MAPS (GROUND, 500 mb), TABLES AND BRIEF SCIENTIFIC ARTICLES, DECEMBER [METEOROLOGISCHE ABHANDLUNGEN. BAND 120, HEFT 12: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1971. TAEGLICHE WETTERKARTEN (BODEN, 500 mb), TABELLEN UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, DEZEMBER]

1971 205 p refs In GERMAN
Avail: Issuing Activity

Synoptic daily meteorological data are presented that were obtained during December, 1971, at ground level and 500 mb for the Northern Hemisphere. A high pressure zone over central Europe produced dryness over larger areas of central and western Europe while the precipitation values in northern and eastern Europe and in Siberia were quite high. Included brief scientific studies pertain to local Berlin pollution, radioactivity, and climatological measurements. G.G.

N72-26489*# Scientific Translation Service, Santa Barbara, Calif.

ELECTRICITY OF CLOUDS

I. M. Imyanitov, Ye. V. Chubarina, and Ya. M. Shvarts Washington NASA Jun. 1972 126 p refs Transl. into ENGLISH of the publ. "Elektrichestvo Oblakov" Hydrometeorol. Press, Leningrad, 1971
(Contract NASw-2035)
(NASA-TT-F-718) Avail: NTIS HC $3.00 CSCL 04B

Recent studies of the electrical structure of clouds, processes leading to their electrification, and the possibility of controlling their formation by electrical means are reviewed. The electrical properties of stratiform clouds, convective clouds without rain, and cumulonimbus clouds are described. The electrification of particles in clouds and precipitation, accumulation of space charges in clouds, and the influence of the electrical characteristics of a cloud on its development are considered. Methods of increasing or decreasing the electrical charge in clouds for controlling their development and their breakdown into rain or snow are also discussed. N.E.N.

N72-26490# Weapons Research Establishment, Adelaide (Australia).

THERMOSPHERIC OBSERVATIONS COMBINING CHEMICAL SEEDING AND GROUND BASED TECHNIQUES. PART 1: WINDS, TURBULENCE AND THE PARAMETERS OF THE NEUTRAL ATMOSPHERE

K. H. Lloyd, C. H. Low, B. J. McAvaney (Adelaide Univ.), D. Rees (Univ. Coll., London), and R. G. Roper (Ga. Inst. of Tech.) Nov. 1971 50 p refs
(WRE-TN-532(WR/D)) Avail: NTIS HC $4.50

Two Skylark sounding rockets carrying chemical seeding payloads were launched from Woomera, South Australia (31 deg S, 137 deg E)*in October 1969. In conjunction with these firings, the University of Adelaide conducted ground-based experiments on the upper atmosphere using the radio meteor and spaced receiver drift methods. The measurements of properties of the neutral atmosphere above 90 km which were obtained from these experiments are presented. Author

N72-26491*# Texas A&M Univ., College Station. Dept. of Meteorology.

AN INVESTIGATION OF RELATIONSHIPS BETWEEN MESO- AND SYNOPTIC-SCALE PHENOMENA Final Report

James R. Scoggins, James E. Wood, Henry E. Fuelberg, and William L. Read Washington NASA Jun. 1972 229 p refs
(Contract NAS8-25400)
(NASA-CR-2030) Avail: NTIS HC $3.00 CSCL 04B

Methods based on the vorticity equation, the adiabatic method, the curvature of the vertical wind profile, and the structure of synoptic waves are used to determine areas of positive vertical motion in the mid-troposphere for a period in each season. Parameters indicative of low-level moisture and conditional instability are areas in which mesoscale systems may be present. The best association between mesoscale and synoptic-scale phenomena was found for a period during December when synoptic-scale systems were well developed. A good association between meso- and synoptic-scale events also was found for a period during March, while the poorest association was found for a June period. Daytime surface heating apparently is an important factor in the formation of mesoscale systems during the summer. It is concluded that the formation of mesoscale phenomena may be determined essentially from synoptic-scale conditions during winter, late fall, and early spring. Author

N72-26492*# Dayton Univ., Ohio. Research Inst.

ULTIMATE WIND SENSING CAPABILITIES OF THE JIMSPHERE AND OTHER RISING BALLOON SYSTEMS

James K. Luers and Charles D. MacArthur Washington NASA Jun. 1972 113 p refs
(Contract NAS8-26600)
(NASA-CR-2048) Avail: NTIS HC $3.00 CSCL 04B

The error in the magnitude of the horizontal wind field as computed for balloons with linear and quadratic rise rates ascending through a light, moderate, or severe wind field is derived. The rise rate function of the Jimsphere is analyzed as a special case. Figures are presented of wind error versus altitude for each rise rate and wind field, assuming linear smoothing. The ultimate capability of rising balloon systems for measuring wind from the surface to 18 kilometers can be determined from the data and the wind accuracy can be computed by knowing only the rise rate behavior versus altitude. The radii of smooth and roughened spheres needed to achieve the desired rise rate at various altitudes are derived. The radii for smooth and roughened balloons for tow-meter-per-second to 20-meter-per-second rise rates at 10 and 14 km altitudes, and the wind-following capability for each are tabulated. Author.

N72-26493# Environmental Data Service, Silver Spring, Md.

CATALOG OF METEOROLOGICAL SATELLITE DATA, ESSA 9 TELEVISION CLOUD PHOTOGRAPHY, 1 JANUARY - 31 MARCH 1970

1971 203 p refs
Avail: SOD $2.00

The television cloud photographs, accompanied by tables, obtained by ESSA 9 satellite from January 1, 1970 through March 31, 1970 are presented. Data cover daily cloud distribution over the earth. Stereographic maps are included. E.H.W.

N72-26494# Environmental Protection Agency, Research Triangle Park, N.C. Div. of Atmospheric Surveillance.

AIR QUALITY DATA: DIRECTORY OF AIR QUALITY MONITORING SITES, 1971

Apr. 1972 158 p
(APTD-0979) Avail: NTIS HC $10.00

The Environmental Protection Agency (EPA) operates the National Aerometric Data Bank for storage and retrieval of aerometric data collected by local, state, and Federal air pollution control agencies. Included in the Bank is a limited amount of data collected by private agencies. This directory lists those monitoring sites that collected the aerometric data stored in the Bank. The listings are a condensation of the information contained in the SAROAD Site Identification Forms for each monitoring site. A sample of this form is included. Only those monitoring sites listed with a Federal surveillance system between January 1957 and June 1971 are included in this publication. This site coding information is required for interpretation and analysis of the aerometric data contained in the Bank. Author

N72-26495# Institut Royal Meteorologique de Belgique, Brussels.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Feb. 1972 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, FEVRIER 1971]
Feb. 1971 31 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Synoptic measurements made at different Belgian weather stations in February 1971 are presented. Author (ESRO)

N72-26496# Institut Royal Meteorologique de Belgique, Brussels.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Jun. 1971 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, JUIN 1971]
Jun. 1971 32 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Synoptic measurements made at different Belgian weather stations in June 1971 are presented. Author (ESRO)

N72-26497# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC POLLUTION, SMOKE, AND SULFUR DIOXIDE Monthly Bulletin, Jun. 1971 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX BULLETIN MENSUEL, JUIN 1971]
Jun. 1971 28 p In FRENCH and DUTCH Prepared jointly with Inst. d'Hyg. et d'Epidemiol.
Avail: NTIS HC $3.50

Data obtained at Belgian weather stations are tabulated. The air pollution apparatus is briefly described. Author (ESRO)

N72-26498# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Mar. 1972 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, MARS 1972]
R. Sneyers 1972 16 p refs In FRENCH and DUTCH
Avail: NTIS HC $3.00

Meteorological parameters observed at different Belgian weather stations during March 1972 are given. Author (ESRO)

N72-26499# Environmental Prediction Research Facility (Navy), Monterey, Calif.
THE EFFECTS OF OCEANIC FRONTS ON PROPERTIES OF THE ATMOSPHERIC BOUNDARY LAYER
T. Laevastu, K. Rabe, and G. D. Hamilton Jan. 1972 50 p refs
(AD-738847; ENVPREDRSCHFAC-2-72) Avail: NTIS CSCL 04/2

The theories of Mosby and Amot on the response of boundary layer properties are applied to the computation of air temperature and water vapor pressure at a height of 10 m. above the sea surface. The effects of different empirical constants on the equilibrium differences of the sea and air temperatures and water vapor pressure, were investigated numerically. The application of the Amot-Mosby theory provides a method for synoptic numerical analysis/forecasting of surface air temperature and water vapor pressure over the oceans. Author (GRA)

N72-26500# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 12805 LANCE, MISSILE NO. 2141, ROUND NO. 146 SST (15 FEBRUARY 1972) Meteorological Data Report
Feb. 1972 70 p
(DA Proj. 1T6-65702-D-127)
(AD-738815; DR-692) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12805 Lance, Missile Number 2141, Round Number 146 SST, are presented in tabular form. Author (GRA)

N72-26501# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11602 LANCE, MISSILE NO. 2135, ROUND NO. 145 ESL (11 FEBRUARY 1972) Meteorological Data Report
Feb. 1972 61 p
(DA Proj. 1T6-65702-D-12702)
(AD-738816; DR-694) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 11602 Lance, Missile Number 2135, Round Number 145 ESL, are presented in tabular form. Author (GRA)

N72-26502# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
A 12801 LANCE, MISSILE NO. 2136, ROUND NO. 149 SST, 28 FEBRUARY 1972 Meteorological Data Report
Feb. 1972 58 p
(DA Proj. 1T6-65702-D-127)
(AD-738817; DR-695) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12801 Lance, Missile Number 2136, Round Number 149 SST, are presented in tabular form. Author (GRA)

N72-26503# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 12803 LANCE, MISSILE NO. 2101, ROUND NO. 151 SBL, 7 MARCH 1972 Meteorological Data Report
Mar. 1972 32 p
(DA Proj. 1T6-65702-D-127)
(AD-738819; DR-698) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12803 Lance, Missile Number 2101, Round Number 151 SBL, are presented in tabular form. Author (GRA)

N72-26504# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 12803 LANCE, MISSILE NO. 2122, ROUND NO. 148 ESL, 25 FEBRUARY 1972 Meteorological Data Report
Feb. 1972 63 p
(DA Proj. IT6-65702-D-127)
(AD-738818; DR-696) Avail: NTIS CSCL 04/2

Meteorological data gather for the launching of 12803 Lance, Missile Number 2122, Round Number 148 ESL, are presented in tabular form. Author (GRA)

N72-26505# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
KANSAS 1968 FIELD PROGRAM DATA REPORT
Yutaka Izumi 27 Dec. 1971 85 p refs
(AF Proj. 7655)
(AD-739165; AFCRL-72-0041; AFCRL-ERP-379) Avail: NTIS CSCL 04/2

A field program in micrometeorology was conducted by the Boundary Layer Branch, Meteorology Laboratory, Air Force Cambridge Research Laboratories during the summer of 1968 in southwest Kansas. Measurements of vertical transport of momentum and sensible heat as well as vertical profiles of wind and temperature were obtained. The profile and turbulence statistical data are presented in this report. Author (GRA)

N72-26506# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

METEOROLOGICAL CONDITIONS ASSOCIATED WITH CAT OBSERVATIONS IN PROJECT HAVEN HOP

Samuel Penn, Gary J. Thompson, and Peter A. Giorgio 7 Jan. 1972 30 p refs

(AF Proj. 8628)

(AD-739167; AFCRL-72-0043; AFCRL-AFSIG-236) Avail: NTIS CSCL 04/2

Data from Project HAVEN HOP, an AFCRL clear-air turbulence program, are presented. CAT encounters and associated meteorological data are shown for several individual cases. Analyses of these data showed the stronger CAT to be associated with strong static stability. This is in agreement with theoretical considerations in which K-H instability may form in stable layers associated with strong vertical wind shear. The analyses also suggested an association between CAT and the horizontal shear regions of the jet flow. Author (GRA)

N72-26507# Army Advanced Materiel Concepts Agency, Alexandria, Va.

SMALL-SCALE ATMOSPHERIC MODIFICATION Final Report

David A. Lawson and Frances L. Whedon Jan. 1972 68 p refs

(AD-738534; AMCA-72-004) Avail: NTIS CSCL 04/2

An ad hoc working group was convened to discuss present capabilities and current operational and research and development programs in small-scale atmospheric modification. Relative complexity of fog, individual cumulus, orographic precipitation and severe storms, as far as modification is concerned, were considered. The discussions led to a group consensus of the anticipated state of small-scale modification capabilities 10-20 years in the future. Author (GRA)

N72-26508# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

THE 11601 LANCE, MISSILE NO. 2127, ROUND NO. 143 SPT. (4 FEBRUARY 1972) Meteorological Data Report

Feb. 1972 45 p

(DA Proj. 1T6-65702-D-127)

(AD-738813; DR-690) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 11601 Lance, Missile Number 2127, Round Number 143 SPT, are presented in tabular form. Author (GRA)

N72-26509# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

THE 12807 LANCE, MISSILE NO. 2102, ROUND NO. 144 SSL (8 FEBRUARY 1972) Meteorological Data Report

Feb. 1972 68 p

(DA Proj. 1T6-65702-D-127)

(AD-738814; DR-691) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12807 Lance, Missile Number 2102, Round Number 144 SSL, are presented in tabular form. Author (GRA)

N72-26510# Army Engineer Topographic Labs., Fort Belvoir, Va.

SURFACE CLIMATE OF THE ARCTIC BASIN: SELECTED CLIMATIC ELEMENTS TO THE PERFORMANCE OF SURFACE-EFFECT VEHICLES Technical Report, 1 Jul. 1970 - 30 Jun. 1971

Andrew D. Hastings, Jr. Dec. 1971 105 p refs

(ARPA Order 1615)

(AD-738796; ETL-TR-71-5) Avail: NTIS CSCL 04/2

The report contains maps showing the distribution of monthly means and extremes of temperature, windspeed, dewpoint, and visibility within the Arctic Basin. These elements were selected because of their significance to the design and operation of large, Surface-Effect Vehicles which may be required to perform transportation services in that area. The distributions are derived from a considerable amount of observational data spanning a century of scientific research but primarily from Soviet and United States drifting stations maintained during the last two decades. Author (GRA)

N72-26511# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ULTIMIZATION OF THE EVOLUTION OF LONG WAVES FOR THE FORECASTING OF THE AIR TEMPERATURE BY SEASONS

B. R. Ureva Dec. 1971 37 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchno-Issled. Tsentr. SSSR (USSR), no. 42, 1969 p 75-98

(FTD Proj. 60103)

(AD-738753; FTD-MT-24-1412-71) Avail: NTIS CSCL 04/2

An analysis of the evolution of seasonal pressure waves in the northern hemisphere, and its qualitative evaluation supported by a complex of circulation indices, provides a method of the seasonal forecasting of the anomalies of the air temperature throughout the USSR by calendar months based on the assumption that the seasonal type of circulation is held stable over a period of three months. Typical maps of the anomalies of temperature for the various climatic macroprocesses and for certain intra-seasonal variants were used. Author (GRA)

N72-26512# R and D Associates, Santa Monica, Calif.

MULTIPLE THERMOMETRY IN PALEO CLIMATE

Leona M. Libby Jan. 1972 26 p refs

(Contract F44620-72-C-0025; ARPA Order 1964)

(AD-739261; RDA-TR-031-NMO; AFOSR-72-0588TR) Avail: NTIS CSCL 04/2

The principle of isotope thermometry is that isotope ratios are temperature dependent. It is proposed that isotope ratios in bio-organic material may have independent temperature coefficients, so that by measuring ratios for several elements, e.g. hydrogen, carbon and oxygen, it may be possible to show that a temperature change occurred. Assuming that cellulose is formed almost at equilibrium, temperature coefficients for C, H and O are computed and found measurable size. The coefficients computed for C13/C12 and D/H agree to be of measured values. Thus indications are that temperature changes in past climates may be measured in old tree rings, using this principle of multiple thermometers. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N72-26513 Tennessee Univ., Knoxville.

OPTIMAL CONTROL OF SURFACE TO SURFACE GUIDED MISSILES Ph.D. Thesis

John Leslie Dixon 1971 134 p

Avail: Univ. Microfilms Order No. 71-29456

The feasibility of applying optimization theory for the design of a controller for surface to surface guided missiles is discussed. The experimental data were to provide sufficient information to decide how much better the resulting control schemes were in comparison with conventional control schemes. The experimental data for the investigation was obtained from a computer simulation using parameters and coefficients of a typical surface to surface guided missile. The range of the missile was approximately 30 miles and had a powered flight lasting for 5.12 seconds and attained a speed of approximately Mach 4 during the powered portion of its flight. A control law was derived based on the state regulation of a linear, time variant system resulting from the second variation of the cost function from the nominal optimal cost function. This derivation made use of the minimum principle in which the selection of a cost function resulted in a Hamiltonian function. Dissert. Abstr.

N72-26514 Houston Univ., Tex.
ANALYSIS OF INERTIAL NAVIGATION SYSTEM USING THE METHOD OF INCREMENTAL COEFFICIENTS (MIC) ALGORITHM Ph.D. Thesis
Kishan L. Dudkikar 1971 159 p
Avail: Univ. Microfilms Order No. 71-27868

Removal of two of the most prominent errors, the schulering and the earth rate errors, arising in an inertial navigation system are studied by means of Kalman filtering. These errors are modeled by a combination of two coupled oscillators subjected to additive noise, by using the state variables method (contrary to the approach used in literature using mechanization equations). The application of the MIC algorithm to Kalman filtering is presented. The controllability matrix in the regulator problem (or, the observability matrix in the filtering problem) and the impulse response of the optimal (Kalman) filter are shown to be given by the Psub21(tsub0,t) and Psub11(t,tsub0) matrices (the Psubij(t,tsub0) matrices belong to the MIC algorithm). The duality of the MIC algorithm has been precisely stated. Numerical techniques to integrate the variance equation forwards in time have been largely unsuccessful, except for the MIC algorithm. Criteria of asymptotic stability for the optimal filter is presented. Dissert. Abstr.

N72-26515*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
DETERMINATION OF SOUNDING ROCKET POSITION AND ATTITUDE FROM RADAR AND MAGNETOMETER DATA
Morris Pongratz Jan. 1972 41 p
(Contract NSR-21-002-077; Grant NGL-21-002-008)
(NASA-CR-127110; BN-721) Avail: NTIS HC $4.25 CSCL 17I

The techniques are described that were used to determine the trajectories and orientations of three sounding rockets instrumented to study the aurora. The radar plot board data were fitted to a near earth expansion of the force of gravity to determine the trajectory. Only onboard magnetometer data were used to determine the attitude of the payload with respect to the earth's magnetic field. Computer programs in the FORTRAN language are available which generate the trajectory and attitude parameters. Author

N72-26516*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NAVIGATION FOR SPACE SHUTTLE APPROACH AND LANDING USING AN INERTIAL NAVIGATION SYSTEM AUGMENTED BY DATA FROM A PRECISION RANGING SYSTEM OR A MICROWAVE SCAN BEAM LANDING GUIDANCE SYSTEM
L. A. McGee, G. L. Smith, D. M. Hegarty, R. B. Merrick, T. M. Carson, and S. F. Schmidt (Anal. Mech. Assoc., Mountain View, Calif.) Dec. 1970 41 p refs
(NASA-TM-X-62123) Avail: NTIS HC $3.75 CSCL 17G

A preliminary study has been made of the navigation performance which might be achieved for the high cross-range space shuttle orbiter during final approach and landing by using an optimally augmented inertial navigation system. Computed navigation accuracies are presented for an on-board inertial navigation system augmented (by means of an optimal filter algorithm) with data from two different ground navigation aids; a precision ranging system and a microwave scanning beam landing guidance system. These results show that augmentation with either type of ground navigation aid is capable of providing a navigation performance at touchdown which should be adequate for the space shuttle. In addition, adequate navigation performance for space shuttle landing is obtainable from the precision ranging system even with a complete dropout of precision range measurements as much as 100 seconds before touchdown. Author

N72-26517*# Martin Marietta Corp., Denver, Colo.
IMPROVED GUIDANCE HARDWARE STUDY FOR THE SCOUT LAUNCH VEHICLE
Roger T. Schappell, Michael L. Salis, Ray Mueller, Lloyd E. Best, Albert J. Bradt, Robert Harrison, and John H. Burrell Washington NASA Jun. 1972 246 p refs
(Contract NAS1-10504)
(NASA-CR-2029; MCR-71-158) Avail: NTIS HC $3.00 CSCL 17G

A market survey and evaluation of inertial guidance systems (inertial measurement units and digital computers) were made. Comparisons were made to determine the candidate systems for use in the Scout launch vehicle. Error analyses were made using typical Scout trajectories. A reaction control system was sized for the fourth stage. The guidance hardware to Scout vehicle interface was listed. Author

N72-26518# Lockheed Missiles and Space Co., Palo Alto, Calif.
TWO-GYROSCOPE TRIAXIAL STABILIZER WITH A GYROCOMPASS EFFECT
V. K. Platonov, S. I. Soshnev, and A. Ia. Shaidenko [1972] 5 p refs Transl. into English from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 15, no. 1, 1972 p 89-93
Avail: NTIS HC $3.00; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The performance of two-gyroscope triaxial stabilizer with a gyrocompass effect is analyzed. The effect of the earth's gravitational field and magnetic field on stabilizing geophysical instruments relative to a horizontal coordinate system is discussed. The construction of a test unit and method for using the test equipment are illustrated. Mathematical models are included to amplify the theoretical discussions. Author

N72-26519# Royal Aircraft Establishment, Farnborough (England).
ATTITUDE CONTROL BY PURE JET SYSTEMS
K. J. OMahony Paris ESRO Apr. 1966 32 p refs
(ESRO-TM-36) Avail: NTIS HC $3.75

A theory of satellite attitude control systems using gas jets is studied with the aid of the phase plan, transfer functions, and other techniques. Brief mention was made of the acquisition problems and the electronic circuits associated with the jet valves. Author

N72-26520# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
DIRECTION FINDING OF EMERGENCY RADIO BUOYS BY AIRCRAFT
M. Raab and H.-J. Zetzmann 3 Jan. 1972 93 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-110) Avail: NTIS HC $6.75, DFVLR Porz-Wahn: 29,40 DM

The characteristics of low power radio buoys operating at 2182kHz for search and rescue operations are discussed. The requirements of aircraft direction finders or radio compasses for taking bearings to the buoys is described. The minimum field strength for bearing is presented. Flight tests have demonstrated that the required ranges can be accomplished by accommodating aircraft installations in the form of modified and improved equipment. Author

N72-26521# Joint Publications Research Service, Arlington, Va.
MOTION OF A GYROSCOPE WITH A HOOK'S JOINT AND EXTRA ROTOR
V. Ya. Raspopov, A. Ya. Shaydenko, V. I. Gorin, and Ye. B. Chekalin 12 Jun. 1972 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb., Priborostr. (Leningrad), v. 15, no. 2, 1972 p 75-78
(JPRS-56236) Avail: NTIS HC $3.00

The motion of gyroscope whose flywheel is driven through a Hook's joint equipped with an extra kinetic moment carrier is discussed. The discussion is confined to precession theory. Author

N72-26522# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE QUESTION OF ERRORS OF AN INERTIAL NAVIGATION SYSTEM CONSTRUCTED ON THE BASIS OF A GYRO HORIZON
V. A. Karakashev and S. Ia. Rozhetskii 1972 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 15, no. 4, 1972 p 76-81
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A numerical analysis of the errors of an inertial navigation system constructed on the basis of a gyro horizon is presented. Dependences are obtained for the errors of the system in relation to the instrumental errors of the directional gyroscope and the gyro horizon. Other sources of error are the moments due to gravitational and inertial forces, harmful moments due to the unbalance of the gyrosphere and gyroscopes, the imperfection of the spring unit, and convection fluxes of the sustaining fluid. Mathematical models are included to explain the theoretical aspects. Author

N72-26523# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A TIME-FREQUENCY, HIGH PERFORMANCE COLLISION AVOIDANCE SYSTEM
Roger Gouillou 1972 7 p refs Presented at Ann. Meeting of Inst. of Navigation, West Point, N. Y., 27-29 Jun. 1972
(ONERA-TP-1091) Avail: NTIS HC $3.00

The characteristics of collision avoidance systems used for air traffic control are discussed. A modification of the message format is recommended. Lengthening the pulse from 200 to 800 microseconds is recommended in order to improve the velocity measurement precision. An automatic receiver gain is proposed to reduce the influence of multipaths and make ground synchronization possible. Other advantages of the new format are smaller power requirement and simplified equipment. Author

N72-26524# Little (Arthur D.), Inc., Cambridge, Mass.
CONTINUING STUDIES OF AIR TRAFFIC CONTROL SYSTEM CAPACITY, 1970-1971 Interim Report, Oct. 1970 - Oct. 1971
G. Raisbeck, J. L. Everett, and B. O. Koopman Jan. 1972 30 p refs
(Contract DOT-FA 70WA-2141)
(FAA-RD-72-2) Avail: NTIS HC $3.50

An analysis of air traffic control systems capacity to determine technical and operational factors is presented. The subjects discussed are: (1) a concept of capacity, (2) a measure of safety, (3) analytical tools from the theory of queues, (4) analysis of system functions, (5) description of system parameters, and (6) applications to current air traffic control problems. Author

N72-26525# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
THE OPTIMALITY OF PROPORTIONAL NAVIGATION
J. K. Hammond Mar. 1972 47 p refs
(Min-Def/PE-AT/2040/089/GC)
(AASU-313) Avail: NTIS HC $4.50

Several cost functions were chosen for the judgment of homing systems. Control laws were found to optimize these cost functions, and the theoretical optima obtained are compared to the performance of conventional proportional navigation (P/N). The P/N systems compare favorably with the optimal systems. Author (ESRO)

N72-26526# Federal Aviation Administration, Washington, D.C. Air Traffic Service.
SIMULATION OF TERMINAL CONTROL CORRIDOR, BOSTON, MASSACHUSETTS Final Report, Nov. 1970 - Sep. 1971
Daniel J. Enright and Edwin H. Price Sep. 1971 57 p refs
(AD-739130; FAA-AT-71-1) Avail: NTIS CSCL 17/7

The purpose of the project was to demonstrate to the aviation industry the effectiveness and feasibility of the terminal control corridor concept in comparison with actual traffic, the terminal control area concept and modifications to the industry developed control corridor concept. Author (GRA)

N72-26527# International Business Machines Corp., Owego, N.Y. Electronics Systems Center.
RANGE-ONLY MULTIPLE AIRCRAFT NAVIGATION SYSTEM (ROMANS) Final Report
Phillip D. Danker, Charles W. Witt, and H. H. Christensen Griffiss AFB, N. Y. RADC Feb. 1972 141 p refs
(Contract F30602-71-C-0027)
(AD-738696; IBM-71-A21-044; RADC-TR-72-22) Avail: NTIS CSCL 17/7

The report describes the system design and flight test evaluation of a Range-Only Multiple Aircraft Navigation System (ROMANS) deployed at Griffiss AFB, Rome N.Y. The ROMANS system consists of a command station, two remote (Beacon) stations, an aircraft station with steering meter capability and an aircraft station which was used on the ground during the test program. In operation, radio pulses initiated at the command station are transmitted to the aircraft both directly and via the remote stations. Distance measurements derived from these pulses are used in the command station computer to determine aircraft position. The system has hardware provision for accepting aircraft altitude data, if available, for use under conditions of poor geometry. Author (GRA)

N72-26395*# Sperry Rand Corp., Phoenix, Ariz.
A TORQUE BALANCE CONTROL MOMENT GYROSCOPE ASSEMBLY FOR ASTRONAUT MANEUVERING
David C. Cunningham and Glen W. Driskill *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 121-126 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 06K

N72-26397*# TRW Systems Group, Redondo Beach, Calif.
A PASSIVE PENDULUM WOBBLE DAMPER FOR A LOW SPIN RATE JUPITER FLYBY SPACECRAFT
Randall C. Fowler *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 135-141 refs (See N72-26377 17-15)
(Contract NAS2-5600)
Avail: NTIS HC $3.00 CSCL 22B

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N72-26528*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NEUTRON RADIATION CHARACTERISTICS OF PLUTONIUM DIOXIDE FUEL
Mojtaba Taherzadeh 1 Jun. 1972 22 p refs
(Contract NAS7-100)
(NASA-CR-127045; JPL-TR-32-1555) Avail: NTIS HC $3.25 CSCL 18J

The major sources of neutrons from plutonium dioxide nuclear fuel are considered in detail. These sources include spontaneous fission of several of the Pu isotopes, (alpha, n) reactions with low Z impurities in the fuel, and (alpha, n) reactions with O-18. For spontaneous fission neutrons a value of (1.95 + or - 0.07) X 1,000 n/s/g PuO2 is obtained. The neutron yield from (alpha, n) reactions with oxygen is calculated by integrating the reaction rate equation over all alpha-particle energies and all center-of-mass angles. The results indicate a neutron emission rate of (1.14 + or - 0.26) X 10,000 n/s/g PuO2. The neutron yield from (alpha, n) reactions with low Z impurities in the fuel is presented in tabular form for one part per million of each impurity. The total neutron yield due to the combined effects of all the impurities depends upon the fractional weight concentration of each impurity. The total neutron flux emitted from a particular fuel geometry is estimated by adding the neutron yield due to the induced fission to the other neutron sources. Author

N72-26529*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPARISON OF NUMERICAL TECHNIQUES FOR THE EVALUATION OF THE DOPPLER BROADENING FUNCTIONS psi(x,theta) AND chi(x,theta)

R. Bruce Canright, Jr. and Thor T. Semler Washington Jun. 1972 34 p refs
(NASA-TM-X-2559; E-6858) Avail: NTIS HC $3.00 CSCL 20H

Several approximations to the Doppler broadening functions psi(x, theta) and chi(x, theta) are compared with respect to accuracy and speed of evaluation. A technique, due to A. M. Turning (1943), is shown to be at least as accurate as direct numerical quadrature and somewhat faster than Gaussian quadrature. FORTRAN 4 listings are included. Author

N72-26530*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

NUCLEAR ELECTRIC PROPULSION MISSION ENGINEERING STUDY DEVELOPMENT PROGRAM AND COSTS ESTIMATES, PHASE 2 REVIEW

15 May 1972 111 p Prepared for JPL
(Contract JPL-953104)
(NASA-CR-127070; GESP-7074) Avail: NTIS HC $7.75 CSCL 21F

The results are presented of the second six-month performance period of the Nuclear Electric Propulsion Mission Engineering Study. A brief overview of the program, identifying the study objectives and approach, and a discussion of the program status and schedule are presented. The program results are reviewed and key conclusions to date are summarized. Planned effort for the remainder of the program is reviewed. Author

N72-26531*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NASA-LEWIS EXPERIENCES WITH MULTIGROUP CROSS SECTIONS AND SHIELDING CALCULATIONS

Gerald P. Lahti 22 Jun. 1972 22 p refs Presented at Am. Nucl. Soc. Meeting, Las Vegas, Nev., 18-22 Jun. 1972
(NASA-TM-X-68080; E-6970) Avail: NTIS HC $3.25 CSCL 18F

The nuclear reactor shield analysis procedures employed at NASA-Lewis are described. Emphasis is placed on the generation, use, and testing of multigroup cross section data. Although coupled neutron and gamma ray cross section sets are useful in two dimensional Sn transport calculations, much insight has been gained from examination of uncoupled calculations. These have led to experimental and analytic studies of areas deemed to be of first order importance to reactor shield calculations. A discussion is given of problems encountered in using multigroup cross sections in the resolved resonance energy range. The addition to ENDF files of calculated and/or measured neutron-energy-dependent capture gamma ray spectra for shielding calculations is questioned for the resonance region. Anomalies inherent in two dimensional Sn transport calculations which may overwhelm any cross section discrepancies are illustrated. Author

N72-26532*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RESULTS OF A PRELIMINARY EXPERIMENTAL INVESTIGATION OF A VAPOR TRANSPORT FUEL PIN

Chester D. Lanzo 1972 22 p refs Presented at 18th Ann. Am. Nucl. Soc. Meeting, Las Vegas, Nev., 18-22 Jun. 1972
(NASA-TM-X-68083; E-6981) Avail: NTIS HC $3.25 CSCL 18J

In-Pile experimental tests were conducted on two fuel pins mounted side-by-side in a holder assembly. The fuel pins consisted of stacked fully enriched UO2 pellets enclosed in a type 316 stainless steel clad 1/2 inch outside diameter and 3 inches in length. Each fuel pin contained four pellets for a total of 22 grams of fuel weight. The experiment was operated to maintain the maximum clad temperature at 395 K corresponding to a fuel temperature at the central void surface of 2350 K. Total primary coolant water flow past the pin holder was calculated to be 110 gallons per minute. Forty-four gallons per minute at a velocity of 36.5 feet per second flowed around each fuel pin. Calculations indicated the maximum heat flux was at the point of the highest temperature and was equal to 0.24 kW/sq cm or 7.62 Btu/hr sq ft. A series of high resolution neutron radiographs of the nuclear fueled vapor transport capsule was taken. The thermal neutrons emitted from the core of the 60 megawatt Plum Brook reactor facility were used. Author

N72-26533# Gulf General Atomic, San Diego, Calif.

THE 40 kWe THERMIONIC POWER SYSTEM FOR A MANNED SPACE LABORATORY

A. J. Gietzen, C. R. Fisher, C. A. Heath, W. G. Homeyer, M. R. Hackney, M. H. Merrill, and J. F. Ingber 1 Jul. 1971 213 p refs
(Contract AT(04-3)-840)
(GULF-GA-A-10535) Avail: NTIS

The design objective is 5 years, i.e., no limits known to be less than five years are included in the design. The reactor contains thermionic fuel elements, in which electrical power is produced, and U-ZrH driver fuel elements. There are enough fuel elements in the reactor to provide a high degree of redundancy at BOL (35%) at the nominal 40 kW(e) design point. Reject heat from the fuel elements is removed by forced convection NaK loops to the primary radiator where it is radiated to space at about 800 K (980 F). Electrical power output from the reactor at about 9 V is carried to a modular power conditioning system where it is processed to higher voltage for transmission to the spacecraft. An alternate power system configuration for cable tether mounting applying the same reactor design is also presented. This configuration offers reduced total system mass and improved electrical performance. Performance characteristics of a system applying a reactor using only thermionic fuel elements and no driver elements are also given. Author (NSA)

N72-26534# California Univ., Livermore. Lawrence Radiation Lab.

CONSIDERATIONS IN THE DESIGN OF FUSION REACTOR BLANKET STRUCTURES

R. W. Werner 20 Jan. 1972 21 p refs Presented at Fusion Vacuum Meeting, Washington, D. C., 27 Jan. 1972 Sponsored by AEC
(UCRL-73673; Conf-720110-1) Avail: NTIS

In the design of moderating blankets surrounding plasmas it is often assumed that the first wall of the blanket is a vacuum vessel. The consequence of this assumption is that a structure is created that is subjected to buckling instability problems because it is compressively loaded. It is the contention of the author that if this vacuum vessel approach is followed, that structural, neutronic, and heat transfer requirements cannot be satisfied simultaneously for the blanket. An alternate design is proposed in which the vacuum vessel is relocated on the magnet side of the blanket. Author (NSA)

N72-26535# Oak Ridge National Lab., Tenn.

FUSION POWER: AN ALTERNATIVE ENERGY SOURCE

Herman Postma [1971] 5 p refs Presented at the Region 3

Conf. on Scanning the Spectrum, Knoxville, Tenn. Sponsored by AEC
(Conf-720401-2) Avail: NTIS

Controlled power from the fusion process does not now exist but its present status as well as its goals, approaches directed toward proving that fusion can eventually be an alternative energy source, are described. The means to scientific proof are pointed out and the series of likely engineering problems that must be solved for fusion power to become economically attractive are described. With the presently cloudy perception, such a realization of fusion power will take thirty years and cost two to four billion dollars. Author (NSA)

N72-26536# Los Alamos Scientific Lab., N.Mex.
THE LASL CONTROLLED THERMONUCLEAR RESEARCH PROGRAM Status Report, Oct. 1970 - Oct. 1971
H. T. Motz, comp. Feb. 1972 120 p refs
(Contract W-7405-eng-36)
(LA-4888) Avail: NTIS

Progress in the LASL controlled thermonuclear research program is reported for the year ending 1971. Programs discussed include; theta pinch, Z-pinch, experimental plasma pinch, quadrupole injection experiment, theoretical plasma physics, and reactor technology. F.O.S.

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N72-26537 Sira Inst., Chislehurst (England).
DIMENSIONS, TOLERANCES, AND otf CHARACTERISTICS OF THE SIRA GROUP 200 MM DOUBLET TEST LENS
T. L. Williams Jun. 1971 18 p refs
(R483) Copyright. Avail: Issuing Activity

A lens design to assess the accuracy of instruments used to measure otf is described. Design efforts were directed toward developing: (1) a test lens with a physically large aperature and a sufficiently high degree of correction so the lens will be sensitive to collimator defects; and (2) a lens test standard with sufficiently good color correction to enable measurements in broad spectral bandwidths. A list of tests which may be carried with the lens, the computed otf results for monochromatic tests, and the average number of carefully measured otf results for polychromatic tests are given. E. H. W.

N72-26538 New York Univ., N.Y.
A UNIFIED OPERATIONAL FORMULATION FOR OPEN RESONATORS AND GUIDES (LASER RESONATORS AND GUIDES) Ph.D. Thesis
Luiz Mauro Vianna Camargo 1971 115 p
Avail: Univ. Microfilms Order No. 71-29665

The discovery that the known Fraunhofer formulation is valid under completely different conditions than the classical ones is discussed. This Fraunhofer zone is valid for a narrow angular spectrum when the axial distance is larger than the optical wavelength. It was found that open guides and cavities (for, example laser resonators, and the guides in optical transmission links) operate in this region. A unified operational method of derivation based on the zone is presented for the functional structure of beam modes and quasi-modes. This method is applied to elliptical electrodes. The same method is applied to study the effect of the active medium on these modes. The medium is of the saturable gain type, and the analytic results here obtained are in qualitative agreement with the numerically computed ones of the literature. Dissert. Abstr.

N72-26539 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
SOUND LEVEL MEASUREMENTS AND ANALYSIS, ACCORDING TO INSTRUCTION OF THE JUDGE OF THE 14TH CIVIL DISTRICT
L. X. Nepomuceno 5 Dec. 1971 25 p In PORTUGUESE; ENGLISH summary
(TR-7104.481) Avail: Issuing Activity

The testimony presented in the Civil Court of Sao Paulo concerning the measurement and analysis of noise is reported. Noise measuring instruments, calibration, spectrum analysis, and international standards are discussed along with the results of frequency and noise level measurements at various points in the city. Transl. by F.O.S.

N72-26540 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
SOUND AND NOISE MEASUREMENTS AND OCTAVE BAND ANALYSIS: TECHNICAL AND LEGAL IMPLICATIONS OF COMPLAINING NEIGHBOURS
L. X. Nepomuceno 27 Mar. 1972 9 p In PORTUGUESE; ENGLISH summary
(TR-7203.574) Avail: Issuing Activity

The results of acoustic measurements in the refrigeration room of the Cantina La Tavola located in the residential district of Rua Rui Barbosa of Sao Paulo are analyzed by db, and frequencies. Noise levels in the nearby residences are also presented. The problems of noise pollution, and the annoyance caused to the neighbors, are discussed. Transl. by F.O.S.

N72-26541 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
INDUSTRIAL NOISES: SPECTRA AND COMMENTS ON DIFFERENT INDUSTRIAL NOISES
L. X. Nepomuceno Nov. 1971 28 p In PORTUGUESE; ENGLISH summary Presented at 1st Simp. Poluicao Sonora, Rio de Janeiro, 22-26 Nov. 1971
Avail: Issuing Activity

A historical background on the development of industrial noise is presented with comments on the interrelation between such noises and the community. A series of octave spectra is presented of noises in various industries that show an excessive level. Some suggestions on the proper way to prevent noise in industry are included. Author

N72-26542 British Broadcasting Corp., Kingswood (England). Research Dept.
ARTIFICIAL REVERBERATION
N. F. Spring and C. L. S. Gilford 1972 8 p refs
(BBC-1972/19; PH-87) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Existing systems of artificial reverberation are briefly appraised and their defects discussed. Some possible systems are described and their potentialities assessed. It is concluded that these would be free from the defects of existing systems, but that they would probably be costly. Author

N72-26543*# National Aeronautics and Space Administration, Washington, D.C.
NEW METHODS OF STUDYING NOISE AND VIBRATION AND CYBERNETIC DIAGNOSIS OF MACHINES AND MECHANISMS
K. M. Ragulskis, ed. May 1972 173 p refs Transl. into ENGLISH of the publ. "Novyye Metody Issledovaniy Shumov i Vibratsiy i Kiberneticheskaya Diagnostika Mashin i Mekhanizmov" Kaunas Polytech. Inst., Kaunas, USSR, 1970 Conf. held at Kaunas, USSR, 29 Jun. - 1 Jul. 1970
(NASA-TT-F-694) Avail: NTIS HC $3.00 CSCL 20A

Summaries are presented of conference papers on noise and vibration studies. Among the topics covered are the following: industrial noise; vibrations of machines and machine parts; hydrodynamic noise; aircraft, ship, and motor vehicle noise; random vibrations; vibration damping; noise reduction; vibration and noise measuring instruments; and methods of noise and vibration calculation. N.E.N.

N72-26544# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS, MAY 1972
May 1972 45 p refs
Avail: NTIS HC $4.25

A new approach to the nonisothermal steady state dendritic growth problem is presented which allows determination of both the dendrite shape and growth rate as a function of supercooling. The nonlinear steady state equations are considered as operator equations in an appropriate Banach space, and the shape induced by the nonisothermality is found by linearizing the equations about the isothermal solution. Of major importance, the conditions necessary for the existence of a solution to the linearized equations provide a theoretical limit on the growth rates. Also included are research progress notes on acoustics, chemistry, electronics, laser and optical physics, mathematics, and metallurgy. Author

N72-26545*# Martin Marietta Corp., Denver, Colo.
INSULATION SYSTEMS FOR LIQUID METHANE FUEL TANKS FOR SUPERSONIC CRUISE AIRCRAFT Final Report
H. F. Brady and D. DelDuca Jun. 1972 199 p
(Contract NAS3-12425)
(NASA-CR-120930; MCR-72-42) Avail: NTIS HC $12.00 CSCL 20L

Two insulation systems for tanks containing liquid methane in supersonic cruise-type aircraft were designed and tested after an extensive materials investigation. One system is an external insulation and the other is an internal wet-type insulation system. Tank volume was maximized by making the tank shape approach a rectangular parallelopiped. One tank was designed to use the external insulation and the other tank to use the internal insulation. Performance of the external insulation system was evaluated on a full-scale tank under the temperature environment of -320 F to 700 F and ambient pressures of ground-level atmospheric to 1 psia. Problems with installing the internal insulation on the test tank prevented full-scale evaluation of performance; however, small-scale testing verified thermal conductivity, temperature capability, and installed density. Author

N72-26546*# Scientific Translation Service, Santa Barbara, Calif.
INFLUENCE OF AIR FLOW ON THE ACOUSTIC CHARACTERISTICS OF AN EXPANSION CHAMBER FILTER
Hirata Yoshimutsu Washington NASA Jun. 1972 18 p refs Transl. into ENGLISH from Nippon Onkyo Gakkaishi, (Tokyo), v. 27, no. 10, Oct. 1971 p 501-507
(Contract NASw-2035)
(NASA-TT-F-14296) Avail: NTIS HC $3.00 CSCL 20A

Theoretical and experimental studies on the effects of air flow on sound wave propagation in engine mufflers are presented. Equations are developed to express the acoustic impedance at the open end of a chamber where the air is ejected, and to express the air flow effects on an expanded tube, a contracted tube, and on an expansion chamber filter. An experimental expansion chamber filter is described which produces a flow velocity of up to 50 m/sec. Sound pressure is measured by a microphone with and without the muffler attached, and is analyzed with a narrow band frequency analyzer. It was impossible to make adequate measurements of the sound pressure at frequencies below 300 Hz when the average flow velocity was 40 m/sec. N.E.N.

N72-26547*# Scientific Translation Service, Santa Barbara, Calif.
CALCULATION OF THE PROPERTIES OF RESONATOR TYPE MUFFLERS
J. Okuda Washington NASA Jun. 1972 26 p refs Transl. into ENGLISH from Nippon Onkyo Gakkaishi (Tokyo), v. 27, no. 8, 1971 p 363-372
(Contract NASw-2035)
(NASA-TT-F-14294) Avail: NTIS HC $3.50 CSCL 20A

The noise reducing effect of a muffler is deduced by means of the four-terminal constants of the equivalent electrical network of the whole muffler system. The resonator type muffler is efficient only in the region near the first resonant frequency, and the loss at the mouth of the resonator is not negligible. Estimations of this loss and of the noise reducing curve are obtained by graphical methods. When the connecting points of the resonator cavity and the pipe are in two locations or are distributed throughout, the four-terminal constants can be determined from given equations. When the distance between the two connecting points or the distributing length of connecting points and the total connecting area are very large, the muffler is approximately equivalent to an expansion chamber type muffler. Author

N72-26548*# Scientific Translation Service, Santa Barbara, Calif.
EVALUATION OF THE DEGREE OF DIFFUSENESS IN REVERBERATION CHAMBERS BY SPATIAL CORRELATION TECHNIQUES
M. Koyasu and M. Yamashita Washington NASA Jun. 1972 26 p refs Transl. into ENGLISH from Nippon Onkyo Gakkaishi (Tokyo), v. 26, no. 3, 1971 p 132-143
(Contract NASw-2035)
(NASA-TT-F-14293) Avail: NTIS HC $3.50 CSCL 20A

A method based on spatial correlation techniques to evaluate the degree of diffuseness of the sound field in a reverberation chamber is described. Many distribution patterns were made for various sound field conditions in two reverberation chambers. From the experimental results, it is concluded that the distribution pattern was closely related to the condition of the sound fields. An especially close correlation was observed between diffuseness of the sound field and the area of the distribution pattern. Therefore, to judge diffuseness it is sufficient to consider only the area, and the diffusivity index. The dependence of measured reverberant absorption coefficients of the material on the diffusitivity index were investigated, and a close dependence was observed between them. Author

N72-26549# CEGB Information Services, London (England).
ACOUSTIC EMISSION TESTING, 1950 - FEBRUARY 1972 A Comprehensive Bibliography
P. G. Williams Apr. 1972 33 p refs
(CE-BIB-222) Avail: NTIS HC $3.75

A bibliography, containing 124 references, on acoustic emission is presented. These data provide comprehensive coverage of acoustic emission as a nondestructive testing technique for flaws in metals and nonmetals, locating defects in pressure vessels in service, inspecting welds, proof testing of structures, stress corrosion detection, fracture mechanics analysis, and phase transformation investigations. E.H.W.

N72-26550*# Rice Univ., Houston, Tex.
A TRANSIENT SOLUTION FOR DOMAIN WALL MOTION
H. C. Bourne, Jr. [1972] 9 p refs
(Grants NGR-44-006-001; NSF GK-3827)
(NASA-CR-127036) Avail: NTIS HC $3.00 CSCL 12A

An analytic solution of transient wall motion in a bulk ferromagnetic material is obtained from the dynamic torque equations with a Gilbert damping term. The steady state solution reduces to previously obtained, well known solutions. Author

N72-26551*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTICAL ABSORPTION IN FUSED SILICA AT ELEVATED TEMPERATURES DURING 1.5-MeV ELECTRON IRRADIA-

TION

Albert B. Smith Washington Jun. 1972 36 p refs
(NASA-TN-D-6840; E-6595) Avail: NTIS HC $3.00 CSCL 20F

An experimental determination of the optical transmission of Corning 7940 UV and Suprasil 1 and 2 fused silica has been made during 1.5-MeV electron bombardment. The fused silica reached temperatures ranging from 150 to 1000 C. The Lewis Research Center dynamitron provided electron current densities which corresponded to a dose rate of 2.6 to 20 Mrad/sec. The irradiation induced absorption was measured at 215.0, 270.0, and 450.0 nm (2150, 2700, 4500 A). The length of each irradiation was sufficient so that an equilibrium between radiation induced coloration and high temperature annealing was reached. The experimental results indicate a significant optical absorption, with values of the induced absorption coefficient at 215.0 nm (2150 A) of 14.5 to 2.2/cm, at 270.0 nm (2700 A) of 9.7 to 3.0/cm and at 450.0 nm (4500 A) of 3.7 to 0.5/cm. This would make the use of fused silica as the separating wall material in the nuclear light bulb propulsion concept questionable.
Author

N72-26552*# Old Dominion Univ. Research Foundation, Norfolk, Va.

PERFORMANCE AND NOISE GENERATION STUDIES OF SUPERSONIC AIR EJECTORS

P. S. Barna Washington NASA Jun. 1972 80 p refs
(Contract NAS1-9635)
(NASA-CR-2056) Avail: NTIS HC $3.00 CSCL 20A

Experimental investigations were conducted to determine the aerodynamic performance and noise generation characteristics of five ejectors having subsonic secondary flow. Primary nozzles with equal exit area for Mach numbers 1, 1.5, 2, 2.5, and 3 produced a variety of noise and pumping effects. The pumping capacity, specific power, and noise generation of the Mach 1 nozzle was the highest and its mass augmentation was the lowest among the nozzles tested. The Mach 3 nozzle was found superior in mass augmentation and it also produced the lowest noise, however its pumping capacity and specific power was the lowest.
Author

N72-26553*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MEASUREMENT OF RELATIVE CROSS SECTIONS FOR SIMULTANEOUS IONIZATION AND EXCITATION OF THE HELIUM 4 2s AND 4 2p STATES

John F. Sutton Washington Jun. 1972 96 p refs
(NASA-TR-R-378; G-1046) Avail: NTIS HC $3.00 CSCL 20H

The relative cross sections for simultaneous ionization and excitation of helium by 200-eV electrons into the 4 2s and 4 2p states were measured via a fast delayed coincidence technique. Results show good agreement with the relative cross sections for single electron excitation of helium and hydrogen. An application of the results of the measurement to the development of ultraviolet intensity standard is suggested. This technique involves the use of known branching ratios, a visible light flux reference, and the measured relative cross sections. Author

N72-26554*# Scientific Translation Service, Santa Barbara, Calif.

CALCULATION OF THE PROPERTY OF EXPANSION CHAMBER TYPE MUFFLERS

J. Okda Washington NASA Jul. 1972 17 p refs Transl. into ENGLISH from J. Acoust. Soc. Japan (Tokyo), v. 25, no. 3, 1969 p 122-129
(Contract NASw-2035)
(NASA-TT-F-14288) Avail: NTIS HC $3.00 CSCL 20A

To express the noise reducing effect of a muffler in terms of the difference in the sound power levels radiated from the tailpipe exit with and without the muffler in the system, equations are deduced by means of the four-terminal constants (A B C D) of the equivalent electrical network of the whole muffler system. Measured curves are in good agreement with those obtained by graphical methods so far as the sound wave in the chamber can be regarded as a plane wave. In the higher frequency range above the lowest resonance frequency in the direction perpendicular to the axis of the chamber, the sound wave cannot be regarded as a plane wave, and noise reduction may not be expected.
Author

N72-26555*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMBINED BUOYANCY AND FLOW DIRECTION EFFECTS ON SATURATED BOILING CRITICAL HEAT FLUX IN LIQUID NITROGEN

S. S. Papell 1972 16 p refs Proposed for presentation at 1972 Cryog. Eng. Conf. Boulder, Colo., 9-11 Aug. 1972
(NASA-TM-X-68086) Avail: NTIS HC $3.00 CSCL 20L

Buoyancy effects on the critical heat flux and general data trends for a liquid nitrogen internal flow system were determined by comparison of upflow and downflow data under identical test conditions. The test section had a 1.28 cm diameter flow passage and a 30.5 cm heated length which was subjected to uniform heat fluxes through resistance heating. Test conditions covered a range of pressures from 3.4 to 10.2 atm, inlet velocities from 0.23 to 3.51 m/sec, with the liquid nitrogen temperature at saturated inlet conditions. Data comparisons showed that the critical heat flux for downflow could be up to 36 percent lower than for upflow. A nonmonotonic relationship between the critical heat flux and velocity was determined for upflow but not for downflow. A limiting inlet velocity of 4.12 m/sec was determined to be the minimum velocity required to completely suppress the influence of buoyancy on the critical heat flux for this saturated inlet flow system. A correlation of this limiting fluid velocity is presented that was developed from previously published subcooled liquid nitrogen data and the saturated data of this investigation. Author

N72-26556# Aeronautical Research Council (England).

PAPERS ON NOVEL AERODYNAMIC NOISE SOURCE MECHANISMS AT LOW JET SPEEDS

May 1972 71 p refs Supersedes ARC-32925
(ARC-CP-1195) Avail: NTIS HC $5.75; HMSO £1.13; PHI $4.90

Studies relating to aerodynamic noise sources and the calculation of their sound fields for subsonic jet speeds are presented. For individual titles, see N72-26557 through N72-26561.

N72-26557# Imperial Coll. of Science and Technology, London (England). Dept. of Mathematics.

SOUND GENERATION BY TURBULENCE CONTAINED IN A SMALL VESSEL

John E. FfowcsWilliams *In* Aeron. Res. Council Papers on Novel Aerodyn. Noise Source Mech. at Low Jet Speeds May 1972 6 p (See N72-26556 17-23)
Avail: NTIS HC $5.75; HMSO £1.13; PHI $4.90

The sound pressure and the resonance bandwidth are determined exterior to a small vessel in which turbulence and turbulent combustion are contained, as a model of a jet engine combustion chamber. The vessel constitutes a Helmholtz resonator whose acoustical properties are easily described. The sound can be determined from the motion at the neck, which acts upon the environment like a monopole source. Nonresonant and resonant cases are examined, and it is found that the main response is likely to be at resonance, with a broad resonance bandwidth at low Mach number. Author (ESRO)

N72-26558# Imperial Coll. of Science and Technology, London (England). Dept. of Mathematics.

TRANSMISSION OF LOW FREQUENCY JET PIPE SOUND THROUGH A NOZZLE FLOW

John E. FfowcsWilliams *In* Aeron. Res. Council Papers on Novel Aerodyn. Noise Source Mech. at Low Jet Speeds May 1972 7 p (See N72-26556 17-23)
Avail: NTIS HC $5.75; HMSO £1.13; PHI $4.90

The unsteady conditions at the nozzle exit and the sound field radiated to the static homogeneous environment exterior to a jet pipe, with a low frequency sound wave superimposed upon the basic subsonic flow, are determined. It is found that the effect of the nozzle is not very marked, unless the contraction ratio is higher than in normal jet engine configurations. The influence of the nozzle transmission properties on the velocity dependence of aerodynamic sound is investigated, and the conclusion is that aerodynamic sources contained within the jet but positioned many wavelengths upstream of the nozzle will generate sound depending on jet velocity in precisely the same way as if the sources were in direct communication with the nozzle exterior. Author (ESRO)

N72-26559# Imperial Coll. of Science and Technology, London (England). Dept. of Mathematics.
RADIATION PROPERTIES OF THE SEMI-INFINITE VORTEX SHEET
D. G. Crighton *In* Aeron. Res. Council Papers on Novel Aerodyn. Noise Source Mech. at Low Jet Speeds May 1972 24 p refs Supported by Min. of Technol. (See N72-26556 17-23)
Avail: NTIS HC $5.75; HMSO £1.13; PHI $4.90

An exact calculation is given of the acoustic radiation from a time dependent flow coupled to an inhomogeneous solid surface. Specifically, the flow consists of a vortex sheet leaving a semi-infinite plate and undergoing a two-dimensional spatial Kelvin-Helmholtz instability. In the absence of the plate, such an instability mode of the vortex sheet generates no sound. The intensivity-directivity law is approximated for rigid and compliant plates. The results agree with those predicted from general theories of the scattering of the near-field of point quadrupoles by large wedge-shaped surfaces. The influence upon the sound field of rectified and full Kutta conditions is shown. Author (ESRO)

N72-26560# Imperial Coll. of Science and Technology, London (England). Dept. of Mathematics.
DIFFRACTION RADIATION
H. Levine (Stanford Univ., Calif.) *In* Aeron. Res. Council Papers on Novel Aerodyn. Noise Source Mech. at Low Jet Speeds May 1972 5 p (See N72-26556 17-23)
Avail: NTIS HC $5.75; HMSO £1.13; PHI $4.90

The energy radiated by a moving sound source near the edge of a semi-infinite plane is calculated. If localized sources with an invariable strength are in uniform rectilinear motion at subsonic speed past the edge, there is no primary radiation and only indirect or diffraction radiation, whose time-varying sources are continuously distributed over the plane. Such radiation is emitted when the source is near to the impact distance from the edge, and the total amount of energy radiated depends on the source strength and polarization, the Mach number, and impact distance. The influence of impact distance and Mach number is determined. Author (ESRO)

N72-26561# Imperial Coll. of Science and Technology, London (England). Dept. of Mathematics.
SCATTERING OF QUADRUPOLE SOURCES NEAR THE END OF A RIGID SEMI-INFINITE CIRCULAR PIPE
F. G. Leppington *In* Aeron. Res. Council Papers on Novel Aerodyn. Noise Source Mech. at Low Jet Speeds May 1972 14 p refs (See N72-26556 17-23)
Avail: NTIS HC $5.75; HMSO £1.13; PHI $4.90

The distant sound field induced by a region of turbulence near a jet exit is examined by using a pipe model. The model problem chosen to represent the situation is that of a perfectly rigid semi-infinite circular pipe of negligible thickness. The problem is posed as one of diffraction theory with an incident quadrupole distribution assumed to be of known strength with a harmonic time dependence taken throughout. The problem is solved for wavelengths longer than the radius of the pipe. Author (ESRO)

N72-26562# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
NON-LINEAR THEORY OF TRANSIT TIME MAGNETIC PUMPING IN TOROIDAL GEOMETRY
E. Canobbio Oct. 1971 9 p refs Presented at Conf. on Plasma Theory, Kiev, 19-23 Oct. 1971
(EUR-CEA-FC-621; Conf-711016-9) Avail: AEC Depository Libraries

An exact method for deriving the power absorbed by T.T.M.P. (Transit Time Magnetic Pumping) is outlined for the low nu region, nu being the Coulomb scattering time. The variational method used was recently introduced by Rosenbluth to derive the diffusion coefficients in the banana region, from the full Fokker-Planck collision operator. NSA

N72-26563# Wyle Labs., Inc., Huntsville, Ala.
TABLES OF ABSORPTION AND VELOCITY OF SOUND IN STILL AIR AT 68 F, 20 C
L. B. Evans and H. E. Bass (Mississippi Univ.) Jan. 1972 71 p
(Contract DAHC04-69-C-0088)
(AD-738576; WR-72-2; AROD-8725:6-E) Avail: NTIS CSCL 20/1

Tables are presented for the absorption and velocity of sound in still air at 68F (20C). The absorption is presented in dB/1000 ft, dB/Km, and dB/sec. The velocity is presented in 1000 ft/sec. The tables cover the frequency range of 12 Hz - 1 MHz and for relative humidities of 0% - 100%. An appendix is included which presents analytical expressions that will duplicate the tables within 3% over all frequencies and humidities. Author (GRA)

N72-26564# Honeywell, Inc., Seattle, Wash. Marine Systems Center.
COVARIANCE STRUCTURE OF SURFACE REVERBERATION Final Report
R. L. Swarts 10 Mar. 1972 80 p refs
(Contract N00014-69-C-0317; NR Proj. 186-500)
(AD-738971; Rept-2387) Avail: NTIS CSCL 20/1

It has been recognized for some time that the design of an optimum receiver, in the Neyman-Pearson sense (i.e., minimum probability of a missed detection for a given false-alarm rate), depends on a knowledge of the covariance structure of the noise into the receiver. In fact, if the noise is Gaussian, the noise covariance function is a sufficient noise statistic for the design of such a receiver. There is, therefore, ample incentive both for studying models which predict this function and for determining whether the noise is Gaussian. The report is concerned primarily with the results of surface backscatter experiments aimed at testing the validity of the Faure-Olshevskii-Middleton (FOM) model for reverberation which can be used to predict surface reverberation covariance functions. However, in the process of interpreting the data, some results are also presented concerning the Gaussianness of the observed reverberation. Author (GRA)

N72-26565# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
OPTICAL EQUIPMENT Final Report
25 Feb. 1972 8 p
(AD-738543; TOP-10-3-106) Avail: NTIS CSCL 20/6

The report describes a method for evaluation of optical equipment operational and functional performance characteristics. It identifies supporting tests, facilities, and equipment required. It provides procedures for safety, visual resolution range, infrared detection and range resolution, and depth perception (stereoscope). Author (GRA)

N72-26566# Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
TARGET DETECTION IN HOMOGENEOUS NOISE BACKGROUNDS USING Summary Report
Robert A. Rasmussen and Norman Head 15 Dec. 1971 10 p refs

(Contract N00014-69-A-0200-6002; NR Proj. 260-103)
(AD-738898; MPL-U-79/71; SIO-Ref-71-30) Avail: NTIS CSCL 17/1

Analysis of subjective studies of contrast and detection thresholds in a black and white CRT display presenting rectangular targets in a homogeneous noise background indicate that these thresholds are invariantly related with respect to changes in bias or even to changes in the transfer characteristic of the display device so long as changes in the input signal-to-noise ratio are small compared to the bias voltage. The results suggest a reduction rate in detection threshold of 1.5 dB per doubling of the target area for targets whose images lie entirely within the fovea. For larger targets this rate rapidly decreases and approaches zero for target subtenses of approximately 10 degrees. The observed threshold reduction rate of 1.5 dB per doubling of target area is considerably smaller than previously published values of 2.2 dB per doubling. Effects of target presentation time are considered and are suggested as a possible explanation for discrepancies between the present and previously reported measurements. Author (GRA)

N72-26877 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DEVELOPMENT OF A FLUIDIC HIGH-INTENSITY SOUND GENERATOR
Howard F. Wolfe *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 167-178 refs (See N72-26860 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N72-26567 International Atomic Energy Agency, Vienna (Austria).
CINDA 71: AN INDEX TO THE LITERATURE ON MICROSCOPIC NEUTRON DATA
1971 1285 p refs
Avail: Issuing Activity

The CINDA bibliography, which is a eference to specific types of cross section information or other microscopic data on neutron-induced reactions for any target nucleus is presented. The entries are ordered by the target element of isotope, mass number, cross section, energy range from minimum to maximum values of the incident neutron energies, reporting document, and comments. A warning against using the information given in the comments without consulting the original article is included. F.O.S.

N72-26568*# North American Rockwell Corp., Downey, Calif. Space Div.
THE EFFECTS OF RADIATION ON THE OUTER PLANETS GRAND TOUR
Nov. 1971 308 p Prepared for JPL
(Contracts NAS7-100; JPL-953295)
(NASA-CR-127065; SD-71-770) Avail: NTIS HC $17.50 CSCL 18F

A handbook is presented which was designed to accompany an oral presentation on the effects of radiation on the outer planets grand tour (OPGT). A summary of OPGT radiation environments expected from natural sources and the radioisotope thermoelectric generators and basic radiation effects and processes are reviewed, and ionization and displacement effects are examined. The presentation summarizes the effects of radiation on miscellaneous spacecraft materials and devices. The annealing and hardening of electronics are described. Special emphasis is placed on microcircuits. Mathematical modeling of circuits affected by radiation and radiation environmental testing are discussed. A review of means of evaluating the performance and correcting failures of irradiated devices is also presented. Author

N72-26569*# Translation Consultants, Ltd., Arlington, Va.
ON NEUTRON DIFFUSION IN MEDIA WITH PERIODICALLY VARIABLE PARAMETERS
V. M. Novikov and V. L. Blinkin Washington NASA Jun. 1972 26 p refs Transl. into ENGLISH of "O Diffuzii Neytronov v Sredakh s Periodicheski Menyayushchimisya Parametrami", Rept. IAE-2166 Inst. of Atomic Energy, Moscow, 1971 p 1-24
(Contract NASw-2038)
(NASA-TT-F-14317; IAE-2166) Avail: NTIS HC $3.50 CSCL 20H

A kinetic equation of the propagation of neutrons in media, the diffusion-multiplying properties of which are periodically time-dependent, is investigated. It is shown that the dynamics of this system can be described completely by two magnitudes: the dynamic reactivity and the variable component of the neutron flux. The method for calculating the dynamic reactivity is developed in an age-diffusion approximation. A specific calculation is shown for harmonic oscillations of scatterer, fuel, and resonance absorber density. It is shown that the dynamic reactivity has a resonance structure. The relationship between the sign of the dynamic reactivity and system parameters is investigated. Author

N72-26570# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
GENERALIZED VECTOR DOMINANCE AND HIGH ENERGY ELECTRON-PROTON INELASTIC SCATTERING
Masanori Kobayashi May 1972 16 p refs
(RIFP-149) Avail: NTIS HC $3.00

A generalized vector dominance model which takes into account higher mass contributions was applied to the case of high energy electron-proton inelastic scattering. The model accounts for the scaling behavior as well as the q squared dependence of the virtual photon-proton cross section (predicted with no adjustable parameters) and R in the diffraction region. Author

N72-26571# Rochester Univ., N.Y. Nuclear Structure Research Lab.
X-RAY EXCITATION USING HEAVY IONS WITH ENERGIES TO 120 MeV
K. H. Purser 25 Apr. 1972 37 p refs Presented at Washington APS Meeting, 25 Apr. 1972 Sponsored by NSF
(UR-NSRL-52) Avail: NTIS HC $4.00

The case where heavy ions are used to induce inner shell vacancies is considered. The experimental data presented was chosen to illustrate that when the projectile charge is comparable to that of the target, a completely different mechanism appears to dominate the production of vacancies than that described by direct Coulomb collisions. A quasi-molecular model is used to explain the anomalously large X-ray emission cross sections of argon for a variety of beams ranging from carbon to titanium. The changes produced in the energy and intensity of X-ray lines due to additional vacancies in the same shell and in outer shells are discussed. Applications of heavy ion excitation are considered. Author

N72-26572# Rochester Univ., N.Y. Nuclear Structure Research Lab.
A TREIMAN-YANG TEST FOR THE POLE APPROXIMATION IN Li-6(p,pd)He-4 AT 19 MeV
R. B. Liebert, K. H. Purser, and R. L. Burman Jun. 1972 21 p
(UR-NSRL-55) Avail: NTIS HC $3.25

The reaction was tested for dominance of a pole diagram by measurement of the Treiman-Yang distribution. The resulting distributions were consistent with the isotropic pole predictions in the 0 to 60 MeV/c region of deuteron cluster momentum in Li-6. Absolute cross sections were obtained in the region of the test and were fitted with a plane wave impulse approximation and surface cutoff. The reduced width for a deuteron in Li-6 obtained for a cutoff radius of 5.7 fm was theta sub d squared = 0.23 + or - 0.09 corresponding to an effective deuteron cluster number effective N = 0.13 + or - 0.05. Author

N72-26573# Laboratoire de Physique Theorique et des Hautes Energies, Paris (France).
INELASTIC LEPTON SCATTERING Lectures
M. Gourdin Apr. 1972 102 p refs Presented at 1972 CERN School, Grado, Italy, 15-31 May 1972
(PAR-LPTHE-4) Avail: NTIS HC $7.25

Kinematics are discussed, together with the definition of the hadronic tensor and of the structure functions. The differential cross sections and the asymmetries are computed in the one-photon exchange approximation for e.m. processes and in the local Fermi interactions for weak processes. A study of the constraints due to positivity is presented. Some results of current algebra sum rules are given with a derivation of the asymptotic sum rule for polarization. An application of this sum rule is considered for the high energy limit at fixed q squared. Deep inelastic scattering and scaling for structure functions is introduced. Experimental data is presented for electron-proton and electron-deuterium scattering. The parton model is considered as a simple explanation and representation of the scaling. The quark parton model is introduced as a specific example. Author

N72-26574# Laboratoire de Physique Theorique et des Hautes Energies, Paris (France).
INELASTIC EFFECTS IN VECTOR MESON DOMINANCE
G. Bonneau and F. Martin Apr. 1972 27 p refs
(PAR-LPTHE-3) Avail: NTIS HC $3.50

The influence of inelastic unitarity on vector meson dominance predictions is considered. It is shown that, taking pion pion and pion omega meson channels into account, predictions on omega meson decays can be changed considerably and can be reconciled with experimental results. Rho meson decay is also considered Author

N72-26575# Laboratoire de Physique Theorique et des Hautes Energies, Paris (France).
POLARIZATION EFFECTS IN NEUTRINO AND ANTINEUTRINO SCATTERING. 1: GENERAL RESULTS
M. Gourdin Feb. 1972 32 p refs
(PAR-LPTHE-1) Avail: NTIS HC $3.75

The consequence of locality in neutrino and antineutrino scattering was studied for a polarized spin 1/2 target. Structure functions are defined with their positivity constraints. The Adler test in the forward direction is discussed, and sum rules for the polarization structure functions are derived. Author

N72-26576# Laboratoire de Physique Theorique et des Hautes Energies, Paris (France).
POLARIZATION EFFECTS IN NEUTRINO AND ANTINEUTRINO SCATTERING. 2: THE QUARK PARTON MODEL
M. Gourdin Feb. 1972 18 p refs
(PAR-LPTHE-2) Avail: NTIS HC $3.00

Deep inelastic scattering of neutrinos and antineutrinos from a polarized spin 1/2 target was studied using the theory of Fermi local interaction. The parallel-antiparallel asymmetry was computed using the quark parton model and sum rules are discussed. Author

N72-26577*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN INTEGRAL TEST OF THE INELASTIC CROSS SECTIONS OF Pb AND Mo USING MEASURED NEUTRON SPECTRA
D. F. Shook, D. Fieno, C. H. Ford, and G. N. Wrights 22 Jun. 1972 14 p refs Presented at Ann. Meeting of the Am. Nucl. Soc., Las Vegas, Nev., 18-22 Jun. 1972
(NASA-TM-X-68074; E-6965) Avail: NTIS HC $3.00 CSCL 20H

Comparison of measurements and calculations of fast neutron spectra from a radioactive neutron source inside spheres of Mo or Pb and from a cylindrical reactor containing a thick Pb or Mo reflector are used as a test of ENDF cross sections. The sphere leakage spectra were measured at a sphere-to-spectrometer distance of 2 meters using a 54 Ci spherical Am-Be neutron source. Reactor leakage spectrum measurements were made at the surface of the ZP-1 reactor when bare, with a Pb radial reflector 21 cm thick, and with a metallic Mo radial reflector 10 cm thick. In the case of the thin Mo sphere there is agreement between the calculation and measurement. The Pb calculation is much lower than the measurement except at the highest neutron energy. Two-dimensional calculations of reactor spectra result indicate that the reactor source is reasonably well known. Significant differences in leakage spectrum shape for both Mo and Pb reflectors suggest that there are large uncertainties in the inelastic cross sections for Pb and some for Mo. Author

N72-26578*# Geological Survey, Washington, D.C.
CALIFORNIUM-252 NEUTRON CAPTURE AND DECAY METHODS FOR ELEMENTAL ANALYSIS Final Report
25 Apr. 1972 32 p refs
(NASA Order W-13186)
(NASA-CR-127119) Avail: NTIS HC $3.75 CSCL 20H

The feasibility of using a Cf-252 neutron source in conjunction with a capture and/or decay gamma ray method for elemental analysis on lunar or planetary missions was tested. The general problems of using a Cf-252 neutron source for both decay and capture gamma ray analysis in terrestrial environments included the determination of the capture gamma ray spectra by neutron absorption in various metals used for the space hardware, Cf-252 source encapsulation materials, shielding, geometry, and optimum source size for a space mission. Computer data reduction and data transmission techniques were also investigated. Author

N72-26579# California Univ., Livermore. Lawrence Livermore Lab.
SOCIOECONOMIC IMPACT OF LOW-LEVEL TRITIUM RELEASES TO THE ENVIRONMENT
Jerry J. Cohen and Gary H. Higgins 11 Feb. 1972 19 p refs Presented at Tritium Symp., Las Vegas, Nev., 30 Aug. 1971 Sponsored by AEC
(UCRL-73182-Rev-1; Conf-710809-15) Avail: NTIS

In accordance with current guidance, tritium releases must be kept below quantities where MPC levels are exceeded, and should be kept as low as practicable. Determination of practicability requires an analysis of benefit versus risk considerations. Such an analysis was performed for certain general cases. The analysis is based on a mer value of $250 (a mer is the amount of benefit required to justify a radiation exposure of one manrem), and the nature of tritium distribution in the biosphere, as well as certain demographic factors, are considered. Constraints imposed by exposure guides are observed. Results of the analysis indicate that sqms greater than about $0.10/Ci spent for the control of low level tritium releases might be considered more than would be justified by the environmental risk. The assumptions and calculations are reviewed in detail. The possible social and moral implications of such an analysis are also discussed. Author (NSA)

N72-26580# Argonne National Lab., Ill. Materials Science Div.
FAST NEUTRON RADIOGRAPHY WITH Cf-252
Harold Berger and N. P. Lapinski Jan. 1972 20 p refs
(Contract W-31-109-eng-38)
(ANL-7895) Avail: NTIS

Fast neutron radiography with Cf-252 spontaneous fission neutron sources was investigated using X-ray film, direct exposure methods with either scintillator or hydrogenous intensifier screens;

autoradiographic transfer detectors, of which indium and sulfur appeared to present the best possibilities; and track etch methods with several cellulose nitrate materials. The exposure characteristics of these detectors were determined, and many of the detectors were tested radiographically. For the radiographic tests, emphasis was on observations of rubber and plastic components mounted on a steel base. The conclusion is that fast neutron radiography does not appear satisfactory for general radiographic inspection. The technique may prove useful for special situations, such as the inspection of large or radioactive radiographic objects where small, high intensity sources would offer major advantages. Author (NSA)

N72-26581# Brookhaven National Lab., Upton, N.Y.

POSITRON ANNIHILATION AND ITS APPLICATION TO DEFECT STUDIES IN METALS

A. N. Goland [1971] 54 p refs Sponsored by AEC
(BNL-16517) Avail: NTIS

A review is presented of the application of positron annihilation to studies of imperfect solids, particularly metals. After a brief review of positron physics, a description is given of the behavior of positrons in perfect metals. Experimental methods that are used to extract information about the electronic structure of solids from the annihilation photons are next considered, and experimental results on defects in metals are examined. A vacancy-trapping model currently in use to explain the observations is discussed. NSA

N72-26582# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.

IDENTIFICATION OF MULTICHARGED IONS BY INDUCED ELECTRON EMISSION

U. A. Arifov, E. Mukhamadiev, E. S. Paralis, and A. S. Pasyuk 1971 20 p refs In RUSSIAN
(JINR-P7-6165) Avail: AEC Depository Libraries

The mechanism of the potential electron emission induced by impact of multicharged ions on metal targets is analyzed. Experimental apparatus is described as well as the technique of the electron emission measurements in the presence of a strong magnetic field. The results of measurements of the electron emission coefficient for mixed beams are described for the purpose of their identification. The experimental data obtained are discussed. Author (NSA)

N72-26583# Central Research Inst. for Physics, Budapest (Hungary).

PREPARATION OF GROUP CONSTANTS FOR NEUTRON SHIELDING CALCULATIONS FROM THE EVALUATED NUCLEAR DATA AVAILABLE FROM IAEA

P. Vertes [1971] 6 p refs
(KFKI-71-78) Avail: AEC Depository Libraries

The program ZEBRA-2 is used to produce a group-constant set with a more adequate group scheme than that previously used for neutron shielding calculations. The input scheme for ZEBRA-2 is given, and the program is tested by calculating the fast neutron spectra transmitted through graphite and iron. NSA

N72-26584# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Kernverfahrenstechnik.

INVESTIGATION OF THE PATH OF FLOW OF He-Ar AND He-SF6 MIXTURES IN THE SEPARATION NOZZLE WITH MOLECULAR FLOW TOWARD THE PRESSURE PROBE

K. Bier, H. Brandtstaedter, U. Ehrfeld, and W. Ehrfeld Aug. 1971 57 p refs In GERMAN; ENGLISH summary Prepared in part by Tech. Hochshule, Karlsruhe, West Ger.
(KFK-1440) Avail: AEC Depository Libraries

An experimental technique was developed for analyzing the local flow and diffusion phenomena in rarefied gaseous mixtures. From the angle dependence of the ion currents, which are measured with the mass spectrometer, the flow direction, the local flux, and the speed ratio (i.e., the ratio of the stream velocity to the most probable velocity of thermal motion) can be determined for each component of the gas mixture. Results of such pressure probe measurements, which were made using He/Ar and He/SF6 mixtures in the entire flow field of a large scale separation nozzle model, show that under economically optimum operating conditions of the separation nozzle process, the flow in the nozzle is highly viscous. Deviations from local thermal equilibrium occur throughout large regions of the flow. Results of the measurements also indicate that there is a velocity slip between the components the mixture in some parts of the flow field. Author (NSA)

N72-26585# Rome Univ. (Italy). Inst. of Physics.

THE POMERON COUPLING TO THE LAMBDA PI SYSTEM

A. Merlani and G. Violini 29 Nov. 1971 6 p refs
(Nota-Interna-348) Avail: NTIS HC $3.00

According to the Harari interpretation of the finite energy sum rules duality between Regge poles and resonance, the Pomeron is dual to the background and the remaining Regge poles to the S-channel resonance. This model is applied to the Lambda hyperon pion scattering. Author (ESRO)

N72-26586# Rome Univ. (Italy). Inst. of Physics.

SIMPLE AND GENERAL DERIVATION OF CONSISTENT CONTINUOUS PARAMETER SUM RULES

M. CzekalskiDeAchterberg (Buenos Aires Univ.), C. FerroFontan (Buenos Aires Univ.), and G. Violini 13 Dec. 1971 18 p refs Sponsored partly by Consejo Nacl. de Invest. Ciennt. y Tec. de la Rep. Arg. and Fondazione Angelo della Riccia
(Nota-Interna-350) Avail: NTIS HC $3.00

The general procedure of constructing analytical sum rules for high energy parameters is reviewed. It is shown that generalized continuous parameter dispersion sum rules are expressible as a series whose coefficients are the integer moment finite energy sum rules. The equivalence of several kinds of sum rule is tested for the spin-averaged forward Compton amplitude. Author (ESRO)

N72-26587# Naval Air Development Center, Johnsville, Pa. Crew Systems Dept.

ASSESSMENT OF TEMPERATURE RISE SUPPRESSION BY EDGE LOSSES DURING IRRADIATION

Alice M. Stoll 3 Dec. 1971 18 p refs
(AD-738804; NADC-CS-7104) Avail: NTIS CSCL 14/2

A method is described for determining: (1) the minimum aperture size required to yield temperature rise data free from edge loss effects in measurements made at the center of a site during thermal irradiation of a semi-infinite solid; (2) the magnitude of edge losses due to restriction of the irradiated area to less than the 'no loss' size, and its variation with respect to irradiance level and exposure time; and (3) where the thermal properties of the material are known, the energy absorption rate. The latter, on comparison with the measured incident energy also yields a measure of the absorptivity of the materials. Author (GRA)

N72-26757*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

PRELIMINARY RESULTS ON TRITIUM IN SURVEYOR 3 MATERIAL

E. L. Fireman *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 180-184 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 20H

N72-26628# Radiation Dynamics, Inc., Westbury, N.Y.

PARAMETRIC STUDY OF A NEGATIVE ION DUOPLASMATRON

Nikita Wells and Peter R. Hanley *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 249-256 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

N72-26632# Tokyo Univ. of Education (Japan). Dept. of Physics.
A LAMB-SHIFT POLARIZED ION SOURCE WITH SPIN FILTER
J. Sanada, T. Mikumo, K. Katori, S. Seki, Y. Tagishi, Y. Nojiri, S. Kobayashi (Kyoto Univ.), and H. Sakaguchi (Kyoto Univ.) *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 269-272 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N72-26588 National Lending Library for Science and Technology, Boston Spa (England).
NEUTRALIZATION OF ION BEAM SPACE CHARGE BY INJECTED ELECTRONS
M. D. Gabovich, I. A. Soloshenko, and A. D. Ovcharenko 29 Feb. 1972 7 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 16, no. 5, 1971 p 812-816
(NLL-CTO-799-(9091.9F)) Avail: Natl. Lending Library, Boston Spa Engl.: 1 NLL photocopy coupon

Neutralization of an ion beam space charge by electrons injected into the beam from a heated cathode is investigated. The injection of electrons into the beam is shown to result in a considerable decrease of the radial potential drop, and the beam converges to the axis. The minimum radial potential drop as a function of current and beam energy was studied. A qualitative estimate of this value was found to be in good agreement with experiment. Author

N72-26589*# Stanford Univ., Calif. Inst. for Plasma Physics.
CHARGED-PARTICLE TRANSPORT IN TURBULENT ASTROPHYSICAL PLASMAS
Charles E. Newman, Jr. Mar. 1972 75 p refs
(Grant NGL-05-020-272; Contract N00014-67-A-0112-0062)
(NASA-CR-127113; SUIPR-461) Avail: NTIS HC $5.75 CSCL 20I

The effect of electromagnetic fluctuations, or plasma turbulence, on the motion of the individual particles in a plasma is investigated. Two alternative methods are used to find a general equation governing the time-evolution of a distribution of charged particles subject to both an external force field and the random fields of the fluctuations. It is found that, for the high-temperature, low-density plasmas frequently encountered in the study of astrophysics, the presence of even a small amount of turbulence can have a very important effect on the behavior of the plasma. Two problems in which turbulence plays an important role are treated. Author

N72-26590# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PRODUCTION OF LARGE AREA HIGH CURRENT ION BEAMS
Yukio Okamoto and Hajime Tamagawa Apr. 1972 24 p refs
(IPPJ-122) Avail: NTIS HC $3.25

A microwave ion source with hydrogen beam up to 0.5 amperes at steady state operation with ion energy of 1 keV is discussed. The extraction electrodes are multiple-aperture and are arranged in an accel-decel arrangement with 4 cm diameter. Maximum divergence of the beam is 2 deg from the beam axis. The beam is composed of 85 percent molecular ions, of which either the diatomic or triatomic component could be maximized by adjustment of the gas fed to a discharge region. The source is technologically simple, inexpensive, steadystate, and long lived. The basic concepts underlying the production of ion beams are also described. Author

N72-26591# Nagoya Univ. (Japan). Inst. of Plasma Physics.
MAGNETOHYDRODYNAMIC AND TEARING INSTABILITIES OF A CURRENT CARRYING PLASMA IN A TOKAMAK TYPE DEVICE
Tsuneo Amano, Masahiro Wakatani, and Masami Watanabe Mar. 1972 29 p refs
(IPPJ-121) Avail: NTIS HC $3.50

The stability of a current-carrying plasma in a strong longitudinal magnetic field, such as in Tokamak type devices, against the MHD and tearing instability is investigated. The growth rates of the MHD instability are computed numerically as eigen-values of the equation of motion for several current distributions. The influence of the position of the conducting shell on the stability is also investigated. Author

N72-26592# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany).
THE FLOW OF A SELF-MAGNETICALLY ACCELERATED PLASMA JET INTO A CONVERGENT MAGNETIC FIELD
S. Krause 1972 26 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-22) Avail: NTIS HC $3.50; DFVLR Porz-Wahn: 10.40 DM

The effects relevant to the flow of a self-magnetically accelerated plasma jet into a convergent magnetic field are investigated. Qualitative conclusions are drawn from Ohm's law as to the electromagnetic body forces produced in the flow field. An experiment with a plasma velocity of 10 km per second and a magnetic field strength of up to 9 k Gauss is described. It is experimentally found that, and phenomenologically explained how, the applied magnetic field reacts on the mechanism of the generation of the plasma jet. Author

N72-26593# Brookhaven National Lab., Upton, N.Y.
PROCEEDING OF THE SYMPOSIUM ON ION SOURCES AND FORMATION OF ION BEAMS
Th. J. M. Sluyters, ed. Oct. 1971 168 p refs Symp. held at Upton, N. Y., 19-21 Oct. 1971 Sponsored by AEC
(BNL-50310) Avail: NTIS HC $10.50

The development of ion sources and the formation of ion beams for applications in a wide range of science and technology is considered. Theoretical and technological aspects as well as space propulsion possibilities are presented. For individual titles, see N72-26594 through N72-26637.

N72-26594# Rutherford High Energy Lab., Chilton (England).
DIVERSITY AND UNITY IN SOURCES AND BEAMS
J. D. Lawson *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 1-7 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

After a discussion of the apparent diversity of the requirements for ion sources, and the factors which appear to limit their performance in different situations, it is suggested that nevertheless some underlying unity can be found. An example of this unity is provided by the paraxial beam envelope equation for beams with finite emittance and a normal phase space distribution. The equation is written down in general form, using simple but fully relativistic notation. Various physical situations, usually treated separately, are illustrated by taking different selections from the seven terms. Author (NSA)

N72-26595# Centre National de la Recherche Scientifique, Orsay (France). Inst. d'Electronique Fondamentale.
EXTRACTION OF IONS FROM GAS DISCHARGE SOURCES
Albert Septier *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 9-16 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

After a brief account of the ideas of emittance and brightness of a source, a thorough examination of the properties of the emissive surface of a plasma provides an explanation of the basic differences between electron guns and intense ion

sources and of the superiority of sources that emit ions with high directed velocities. The various extraction techniques used in the main types of sources are described. The difficulties encountered in writing general computer programs for designing high quality optical systems as extractors are summarized.
Author (NSA)

N72-26596# Florida State Univ., Tallahassee.
USE OF A SPIKE CATHODE WITH A DUOPLASMATRON ION SOURCE
K. R. Chapman, L. Rowton, and S. Trimble *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 17-19 refs (See N72-26593 17-25)
(Grant NSF GP-25974)
Avail: NTIS HC $10.50

With the use of a plasma expansion cone to obtain increased output, higher arc currents are necessary to obtain the full advantage of the expansion cone. These increased currents reduce filament life considerably and require a heavier gage filament wire, with higher heat dissipation in the source head, to give an acceptable life. An alternative cathode consisting of a tungsten spike was constructed and has proved very satisfactory.
Author (NSA)

N72-26597# Brookhaven National Lab., Upton, N.Y.
AN ANALYTICAL APPROACH TO THE DESIGN OF A PLASMA EXPANSION CUP
V. Kovarik and Th. J. M. Sluyters *In its* Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 21-25 refs Sponsored by AEC (See N72-26593 17-25)
Avail: NTIS HC $10.50

Proper matching and transport of the extracted ion beam from the plasma surface has been accomplished by the adaption of the Pierce geometry. The region between formation of the plasma in the discharge and the plasma boundary is considered. Proper transport of the primary plasma that is produced in the source and the secondary plasma that is produced in the cup may improve the emittance. It is shown that a significant part of the ions is due to ionization in the cup. These ions will have a directed velocity mainly determined by the physical shape of the expansion chamber in the absence of a magnetic field.
Author (NSA)

N72-26598# Centre National de la Recherche Scientifique, Orsay (France). Inst. d'Electronique Fondamentale.
THEORETICAL AND EXPERIMENTAL STUDY OF THE GAS EFFICIENCY IN A DUOPLASMATRON ION SOURCE
Claude Lejeune *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 27-34 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

The duoplasmatron discharge has two distinct regimes showing themselves by a break in the curves giving variations of arc potential and of extracted ion current as functions of the arc discharge current or gas pressure. Experimental study of the ionized gas allows to describe the different plasmas of the discharge and to specify the physical processes governing their behavior in the two modes of the arc. The basis of the quantitative model of the arc is presented. Its main provisions are in good agreement with experimental data for the discharge properties as well as for the source qualities. Similarity rules of the duoplasmatron type ion source are deduced. They allow the determination of the optimum parameters--for construction and operation of the source--adapted to any specific problem.
Author (NSA)

N72-26599# Saha Inst. of Nuclear Physics, Calcutta (India).
A FRESH LOOK INTO A PLASMA DYNAMICS
N. K. Majundar *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 35-41 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

For a given gaseous system under a given potential difference, Poisson's equation of space charge is solved and spatial potentials are obtained, by-passing conditions that would lead to divergence. The results yield certain simple equations under assumption of cylindrical symmetry. These are utilized to investigate the interrelations between potentials and space charges that would tend to instability unless limited by the existing boundary conditions. When stability occurs at a certain state of sustained discharge it is possible to predict potentials at different parts of the system in terms of the geometrical and boundary parameters. This treatment extracts certain information that needs to be available to an ion source designer for critically assessing his ion source performance.
Author (NSA)

N72-26600# Los Alamos Scientific Lab., N.Mex.
THE BENEFICIAL EFFECT OF AN AIR LEAK INTO THE DUOPLASMATRON OF THE LASL POLARIZED SOURCE
J. L. McKibben *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 43-46 refs Sponsored by AEC (See N72-26593 17-25)
Avail: NTIS HC $10.50

The output beam from a Lamb-shift type of polarized ion source has been approximately doubled by a small leak of various types of gases strange to the normal output. A description of the positive ion source, accel-decel system, magnetic lens, and cesium cell is given. Test results suggest that the space charge is more completely neutralized if ions having distinctly different velocities are present simultaneously in the beam.
Author

N72-26601*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ION SOURCES FOR ELECTRIC PROPULSION c28
Ernst Stuhlinger *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 47-60 refs (See N72-26593 17-25)
(NASA-TM-X-68383) Avail: NTIS HC $3.00 CSCL 21C

Ion systems, which accelerate ions of Cs, Hg, or colloid particles by electrostatic fields, are furthest advanced and ready for application. Four kinds of ion sources have been developed: The contact ionization source for Cs as propellants, the electron bombardment source for Cs or Hg, the RF ionization source for Hg, and the hollow needle spray nozzle for colloidal glycerol particles. In each case, the ion beam must be neutralized by injection of electrons shortly behind the exit orifice to avoid adverse space charge effects.
Author

N72-26602*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAXIMUM PROPELLANT UTILIZATION IN AN ELECTRON BOMBARDMENT THRUSTER c28
Harold R. Kaufman and Allan J. Cohen *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 61-68 refs (See N72-26593 17-25)
(NASA-TM-X-68384) Avail: NTIS HC $3.00 CSCL 21C

Current theory and experimental data on propellant utilization in electron bombardment ion thrusters are reviewed. Because the majority of investigations have been conducted with mercury, the presentation emphasizes that propellant. The results are presented in as general a form as possible to facilitate use in areas other than space propulsion.
Author

N72-26603# Hughes Research Labs., Malibu, Calif.
MECHANISM AND EFFICIENCY OF THE ION GENERATION PROCESS IN ELECTRON BOMBARDMENT ION SOURCES
W. Knauer *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 69-76 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

Diagnostic observations in electron bombardment ion sources are utilized in postulating a source configuration with the highest possible ion generation efficiency. For this ideal configuration the various loss processes are investigated analytically and an expression is derived which yields the energy expenditure as a function of various parameters. Numerical results are given for cesium and mercury ion sources. Comparison of the computed values with energy expenditures, actually measured in Cs and Hg propulsion ion sources shows that the most advanced sources approach their theoretically predicted efficiency limits. Author

N72-26604# Giessen Univ. (West Germany). First Inst. of Physics.

RADIO FREQUENCY ION SOURCES FOR ELECTROSTATIC PROPULSION

Horst W. Loeb *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 77-84 refs (See N72-26593 17-25)

Avail: NTIS HC $10.50

Electrostatic RF ion thrusters with diameters from 4 to 20 cm are under development. After investigation of fundamental properties, proving practicability, optimization of all working parameters, development of auxiliary components, as well as long time and ignition test, a standardized 10 cm RF engine including power conditioning and control units reached laboratory maturity. Industrial development for flight prototype production started with mechanical tests. Moreover, a microthruster and a main propulsion engine are under optimization. RIT engines operate with inductive excited, electrodeless, radio frequency ion sources and use for extraction an ion optical focusing effect. Measurements concerning discharge vessel length variation, extraction system optimization, plasma diagnostics, scaling laws and, beam profile are carried out. Author

N72-26605*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

KAUFMAN THRUSTER DEVELOPMENT AT LEWIS RESEARCH CENTER (LeRC) c28

William R. Kerslake and Paul D. Reader *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 85-92 refs (See N72-26593 17-25)

(NASA-TM-X-68385) Avail: NTIS HC $3.00 CSCL 21C

The current status of research programs on mercury electron bombardment thrusters is reviewed. Future thruster requirements predicted from mission analysis are briefly discussed to establish the relationship with present programs. Thrusters ranging in size from 5 to 150 cm diameter are described. These thrusters have possible near to far term applications extending from stationkeeping to primary propulsion. Beam currents range from 10 mA at to 25 A at accelerating potentials of 500 to 5000 V. Author

N72-26606*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A SURVEY OF KAUFMAN THRUSTER CATHODES c28

Albert J. Weigand and Shigeo Nakanishi *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 93-101 refs (See N72-26593 17-25)

(NASA-TM-X-68386) Avail: NTIS HC $3.00 CSCL 21C

A survey is presented of the various cathodes which were developed and used in the Kaufman ion thruster. The electron bombardment type ion source is briefly described. The general design, operating characteristics, and power requirements are shown for each type of cathode from the refractory metals used in 1960 to the plasma discharge hollow cathodes of today. A detailed discussion of the hollow cathode is given, including starting and cyclic operating characteristics as well as more fundamental design parameters. Tests to date show that the plasma hollow cathode is an efficient electron source with demonstrated durability over 10,000 hours. Author

N72-26607# California Univ., Berkeley. Lawrence Berkeley Lab.

EMITTANCE MEASUREMENTS ON AN ABERRATED CYLINDRICALLY SYMMETRICAL PROTON BEAM

Robert W. Allison, Jr., Robert M. Richter, and Emery Zajec *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 103-106 refs Sponsored by AEC (See N72-26593 17-25)

Avail: NTIS HC $10.50

Four dimensional emittance measurements have been made on an aberrated cylindrically symmetric proton beam. These measurements indicate that even in the presence of nonlinear effects radial symmetry is maintained, and that most of the beam emittance occurs in the radial plane. The presence of magnetic field at the plasma cup has been observed to create a strong nonlinearity when the beam is tightly focused. Author

N72-26608# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

DENSITY DISTRIBUTION MEASUREMENTS

P. A. Charmouard *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 107-112 refs (See N72-26593 17-25)

Avail: NTIS HC $10.50

Experiments with the 750-keV preinjector at Saturne to improve beam brightness are described. The setup to measure beam emittance is briefly described, and the modified plasma expansion cup is discussed. NSA

N72-26609# Los Alamos Scientific Lab., N.Mex.

LASL EXPERIENCE WITH A DUOPLASMATRON FEEDING A 750 kV EXACT PIERCE COLUMN

C. Robert Emigh, Earl A. Meyer, Donald W. Mueller, and Ralph R. Stevens, Jr. *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 113-119 refs Sponsored by AEC (See N72-26593 17-25)

Avail: NTIS HC $10.50

The LAMPF H(+) ion source and 750-kV Pierce accelerating column are designed on the basis of a plane parallel beam of protons 1.4 cm in diameter. Performance meets theoretical expectations within a few percent when account is taken of the extra space charge leading by slower moving molecular ions which make up one-fourth of the beam current. Fast-rising fast-falling, flat-topped pulses of 500 m/sec duration and 50 mA beam current are obtained at 120Hz. The beam has reasonably uniform density, low aberration, and an emittance area under 2m m/rad cm. Experiences with plasma apertures are described. X-ray radiation in the 30 to 50 mA beam current range is very low and is correlated with zero beam current to the Pierce electrodes. Radiation increases sharply outside this design range as expected. Author

N72-26610# National Lab. for High Energy Physics, Ibaraki-Ken (Japan).

PRELIMINARY STUDY OF ION SOURCE AND HIGH GRADIENT COLUMN

S. Fukumoto, S. Inagaki, M. Kobayashi, T. Nishikawa, and S. Takami *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 121-128 refs (See N72-26593 17-25)

Avail: NTIS HC $10.50

A duoplasmatron is tested for the ion source of the Japanese proton synchrotron project. To extract high current ion beams, a large plasma expansion cup is examined, the inside diameter of which is 2.5 cm, and 200 mA beam is obtained, however, the emittance of the beam is large. The proton percentage is about 75%. To improve the beam quality, a plasma cup with a multi-stage expander is tested and the emittance of 0.14 cm-mrad is obtained for 70 mA beam. A vertical model of the open type high gradient accelerating column is designed and constructed. Author (NSA)

N72-26611# Oak Ridge National Lab., Tenn.

INTENSE ION AND NEUTRAL BEAMS WITH EXTRACTION ENERGIES ABOVE keV

O. B. Morgan, Jr. *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 129-135 refs Sponsored by AEC (See N72-26593 17-25)
Avail: NTIS HC $10.50

There are several ion sources now existing that can be used to produce ampere ion beams. The most versatile, simple, compact and efficient of these are modifications of the duoplasmatron. Multi-aperture extraction systems make it possible to extract multi-ampere bright ion beams at energies of tens of keV. These multi-ampere systems require large plasma surfaces with a uniform density. The duoPIGatron is an example of an efficient plasma source that has been developed for these multi-aperture systems. Author (NSA)

N72-26612# California Univ., Livermore. Lawrence Livermore Lab.

A REVIEW OF THE PRODUCTION OF INTENSE ION AND NEUTRAL BEAMS WITH ENERGIES BELOW 10 keV

J. E. Osher *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 137-144 refs Sponsored by AEC (See N72-26593 17-25)
Avail: NTIS HC $10.50

Intense ion and equivalent neutral beam production tends to depend directly on ion source output. At extracted ion energies below 10 keV the space charge problem becomes particularly severe with a corresponding tendency for the ion source to yield a decreased ion beam intensity and an increased beam divergence. This low energy limitation is discussed in moderate detail. Examples of several ion source yielding intense beams for the controlled fusion program are presented. The principle and limitations of each type are given briefly. A summary table is also presented with representative ion beam output data for each source type to better delineate the present state of the art. Author

N72-26613# California Univ., Berkeley. Lawrence Berkeley Lab.

LARGE AREA HIGH CURRENT ION SOURCE

W. R. Baker, K. W. Ehlers, W. B. Kunkel, and A. F. Lietzke *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 145-149 refs Sponsored by AEC (See N72-26593 17-25)
Avail: NTIS HC $10.50

Neutral injection, a method of producing and heating plasmas in certain controlled fusion experiments, requires the development of multiampere ion sources. Reported is the development of a new type of ion source geometry capable of delivering a high ion current density over a large extraction area. Probes used to determine the operating characteristics of the model tested indicate the availability of noise free ion current densities in excess of 1A/sq cm and flat to minus or plus 15 percent over a 4-cm diameter. Author

N72-26614# Atomic Energy of Canada Ltd., Chalk River (Ontario). Applied Physics Div.

SOME FACTORS AFFECTING THE EMITTANCE OF A 100 mA dc DUOPLASMATRON

John H. Ormrod *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 151-155 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

A 100 mA dc duoplasmatron ion source is described. The zmittance of the source is dominated by the shape of the plasma beam boundary which gives a triple peaked emittance pattern. The width of these individual peaks is a measure of the inherent transverse momentum distribution of the ions in the expansion cup. This distribution is affected by the electric and magnetic fields in the source, and some factors that reduce the momentum spread are discussed. Author (NSA)

N72-26615# California Univ., Livermore. Lawrence Livermore Lab.

AN INTENSE 1 kV ION SOURCE FOR CONTROLLED FUSION RESEARCH

John E. Osher and Gordon W. Hamilton *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 157-164 refs Sponsored by AEC (See N72-26593 17-25)
Avail: NTIS HC $10.50

A multi-aperture source has been developed for steady state 1 keV neutral neutral H injection into a controlled fusion experiment. This ion source utilizes a magnetically shaped reflex arc for plasma production over a large area array of aligned accel-decel apertures to yield the desired total output. The total ion current from the 6.35 cm diameter array of 331 apertures is of a Gaussian with a half angle divergence. The normalized beam emittance of 42 cm-m/rad and lens magnet optics are given under typical operating conditions. Author

N72-26616# California Univ., Berkeley. Lawrence Berkeley Lab.

MULTIPLE APERTURE EXTRACTION DESIGN FOR PRODUCING INTENSE ION AND NEUTRAL BEAMS

K. H. Berkner, W. B. Cooper, and R. V. Pyle *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 165-166 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

A calculational and experimental program to optimize the extractor design of high current multiple aperture ion sources is in progress. In general, the computed and measured properties of extractors with circular apertures agree well. Very preliminary tests with a multiple slot extractor are encouraging. Author

N72-26617# Oak Ridge National Lab., Tenn.

THE ORNL MULTI-AMPERE ION SOURCE

W. L. Stirling, R. C. Davis, O. B. Morgan, Jr., and L. D. Stewart *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 167-170 refs Sponsored by AEC (See N72-26593 17-25)
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A multi-ampere ion source is described. The source is operated at steady state at 1 A output with ion energies from 1.5 to 5 keV. For 0.1 second pulses and 10 percent duty cycle, 4-ampere beams are achieved at ion energies from 20 to 40 keV. At 30 to 40 keV, about 60 percent of the beam is within a half angular divergence of 1.2 deg with no magnetic lens. Author

N72-26618# California Univ., Livermore. Lawrence Livermore Lab.

ION SOURCE TECHNOLOGY

Gordon W. Hamilton *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 171-176 refs Sponsored by AEC (See N72-26593 17-25)
Avail: NTIS HC $10.50

A review is presented on technological areas involved in design and assembly of ion sources. Topics covered are electrode materials and design, high voltage and insulator techniques, and assembly and joining techniques. Author

N72-26619# Hughes Research Labs., Malibu, Calif.

ION SOURCE REQUIREMENTS FOR ION IMPLANTATION

R. G. Wilson *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 179-182 (See N72-26593 17-25)
Avail: NTIS HC $10.50

Of the parameters that describe aspects of ion sources, those of greatest concern for application to ion implantation are versatility of ion species produced, ease and quickness of change among ion species, ion current produced, reliability, lifetime, and ease of maintenance. An ion source defined here includes all of the equipment necessary to introduce ions of the desired species into the next element of an implantation system (an accelerator). The components dealt with are the ionization chamber, the feed system for the material to be ionized, the ion extraction region, and all associated electronics. NSA

N72-26620# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).

THE VERY BRIGHT FIELD IONIZATION AND FIELD EVAPORATION ION SOURCES. SOME USES: A BEAM FORMATION AND SCANNING SYSTEM

H. Heil (Hughes Res. Labs.) and R. Guckenberger (Tech. Univ., Munich) *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 183-189 refs
Sponsored by EURATOM (See N72-26593 17-25)
Avail: NTIS HC $10.50

Field ionization and evaporation ion sources, in the form of small wire tips are capable of delivering brightnesses many orders of magnitude larger than conventional sources, with the apparent source size in the 10A range. Therefore, they serve well as small ion probes for scanning instruments. Uses are in surface micro-analysis, microelectronics, electron and X-ray diffraction, and manipulation and treatment of macromolecules. Author

N72-26621# Kyoto Univ. (Japan). Dept. of Electronics.

BEAM PLASMA TYPE ION SOURCE FOR HIGH CURRENT OPERATION

T. Takagi, I. Yamada, and J. Ishikawa *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 191-197 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

To obtain an intense and fine ion beam for ion implantation in semiconductors, a new ion source is studied. By forcing a magnetically focused electron beam through a neutral gas in a drift tube, a plasma is generated. This plasma acquires density orders of a magnitude higher than that expected from the primary ionization alone, since the beam plasma interaction causes the beam plasma discharge when the gas pressure exceeds a certain critical value. Author (NSA)

N72-26622# Los Alamos Scientific Lab., N.Mex.

GADGETS DEMONSTRATING PRINCIPLES INVOLVED IN POLARIZED ION SOURCES

J. L. McKibben *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 199-205 refs
Sponsored by AEC (See N72-26593 17-25)
Avail: NTIS HC $10.50

A pair of spheres 15 cm in diameter and simulating a polarized particle in the restricted sense that they have angular momentum and magnetic dipole have been fabricated. Each is supported on an air bearing and when placed close to each other interact. An external magnetic field has also been made so that aspects of the Breit-Rabi diagram can be visualized. A single sphere placed in the field can be shown to follow the field if it is rotated slowly with respect to the precessional frequency. Another device is a triple pendulum and is used to dramatize the nature of the 3 level quantum mechanical interaction involved in the nuclear spin filter. Author

N72-26623# Stanford Univ., Calif.

A SURVEY OF GROUND STATE ATOMIC BEAM SOURCES

H. F. Glavish *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 207-222 refs
Sponsored in part by NSF (See N72-26593 17-25)
Avail: NTIS HC $10.50

Present ground state atomic beam polarized ion sources are reviewed. The principle of this type of source is discussed briefly, including an account of the main sources of depolarization. Specific developments are considered which have occurred in the last five years. These concern ionization, production of polarized negative ions by charge exchange in sodium vapor, polarization control, and injection into cyclotrons and tandem Van de Graaff accelerators. A section is devoted to future developments which may lead to a higher intensity. Author (NSA)

N72-26624# North Carolina Univ., Chapel Hill.

A REVIEW OF LAMB-SHIFT POLARIZED ION SOURCES

Thomas B. Clegg *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 223-230 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

The recent developments in the field of Lamb shift polarized ion sources are reviewed with an emphasis on the experimental techniques used on the sources now operating and being built. Author (NSA)

N72-26625# Argonne National Lab., Ill.

STATUS REPORT ON THE ZERO GRADIENT SYNCHROTRON (ZGS) H(MINUS) ION SOURCE PROGRAM

J. A. Fasolo, G. J. Marmer, and J. S. Moenich *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 231-236 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

The H(-) ion source was installed in the 750-kV terminal of the high gradient column of the ZGS and used for tests of H(-) injection into the booster. A negative ion beam of 7 mA was accelerated to 750 keV; 6 mA of this was transported to the linac and approximately 3 mA was injected into the linac. With the buncher removal for modification, one-fourth of the injected beam was accepted and accelerated to 50 MeV. One-third of the 50-MeV beam was transported to the booster, where it gave a circulating proton current of 30 mA. The H(-) run was terminated to permit reconversion to proton operation and resumption of ZGS operation following completion of repairs to the octant 3 magnet coil. Author (NSA)

N72-26626# Heidelberg Univ. (West Germany). Physikalisches Inst.

NEGATIVELY CHARGED ATOMIC AND MOLECULAR IONS

H. J. Kaiser, E. Heinicke, H. Baumann, and K. Bethge *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 237-244 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

The production of positive and negative ions of all elements of the sub-groups A and some of the sub-groups B has been investigated as an extension of previous work on Penning sources. Molecular ions of the type Xn(plus or minus), n greater than 1, and ions of the hydride molecules Xn Hm(plus or minus), n, m greater than 1 have been found. The maximum number of the H atoms bound in the cluster was determined by the position of the element in the periodic system. During these investigations some peaks appeared in the mass spectra which corresponded to masses half of that of the negative X ion. The electric and magnetic deflections of these ion beams have shown that these beams are particularly composed of double charged negative ions. Author (NSA)

N72-26627# Rutgers Univ., New Brunswick, N.J.

RUTGERS UNIVERSITY GROUND STATE ATOMIC BEAM POLARIZED ION SOURCE

B. A. McKinnon (Auckland Nucl. Accessory Co.), J. P. Ruffell (Auckland Nucl. Accessory Co.), I. J. Walker (Auckland Nucl. Accessory Co.), A. B. Robbins, R. N. Boyd, and H. F. Glavish (Stanford Univ.) *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 245-248 refs
Sponsored in part by NSF (See N72-26593 17-25)
Avail: NTIS HC $10.50

A polarized proton and deuteron source, based on magnetic separation of a ground state atomic beam, has been built for the large tandem Van de Graaff. Negative ions are formed by charge exchange in sodium vapor. Any direction is possible for the spin axis by using two 90 deg electrostatic deflections and two spin precession solenoids. In factory tests H(-) and D(-) currents in excess of 200 nA were achieved with a high ion optic beam quality. Using the 3H(d,n)4He reaction, polarizations of p sub zz = plus or minus 0.84 were measured. Author (NSA)

N72-26628# Radiation Dynamics, Inc., Westbury, N.Y.

PARAMETRIC STUDY OF A NEGATIVE ION DUOPLASMATRON

c24

Nikita Wells and Peter R. Hanley *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 249-256 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

A parametric study of the operation of a direct extraction negative ion duoplasmatron has been undertaken to optimize the parameters of the source. In a conventional geometry, 230 microampere of H(-) beam was obtained from a 1.3 mm diameter anode aperture, offset 1.0 mm from the discharge axis. Attempts to extract high currents from a concentric annular ring of anode apertures resulted in significantly lower specific yields: i.e., lower current per unit aperture area. Experiments with an anode aperture drilled off-center from the discharge axis show that the distortion of the source magnetic field that results from offsetting the intermediate electrode has a strong effect on the intensity of the extracted beam. Author (NSA)

N72-26629# Los Alamos Scientific Lab., N.Mex.
LAMB-SHIFT POLARIZED ION SOURCE FOR THE LOS ALAMOS MESON PHYSICS FACILITY
G. P. Lawrence *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 257-260 refs Sponsored by AEC (See N72-26593 17-25)
Avail: NTIS HC $10.50

Design objectives and considerations for a polarized proton source are presented. A source of the Lamb-shift type is planned, which in addition to its attractive beam intensity, polarization, and emittance characteristics, possesses other capabilities which considerably increase the potential usefulness of the device. Author

N72-26630# Washington Univ., Seattle.
THE UNIVERSITY OF WASHINGTON LAMB SHIFT POLARIZED ION SOURCE
E. Preikschat, G. W. Roth, J. G. Cramer, and W. G. Weitkamp *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 261-262 refs Sponsored by AEC (See N72-26593 17-25)
Avail: NTIS HC $10.50

A polarized negative ion source has been constructed and installed on Tandem Van de Graaff accelerator. The Lamb shift source uses a Sona field reversal scheme to increase the polarization. Proton beams of 50 nA with 83% polarization and tensor polarized deuteron beams of 60 nA have been observed on target. Author (NSA)

N72-26631# Ohio State Univ., Columbus. Dept. of Physics.
A COMPACT POLARIZED ION SOURCE FOR THE HIGH VOLTAGE TERMINAL OF THE OHIO STATE UNIVERSITY 6-MeV VAN DE GRAAFF ACCELERATOR **c11**
H. P. Schieck, C. E. Busch, J. A. Keane, and T. R. Donoghue *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 263-267 refs Sponsored in part by NSF (See N72-26593 17-25)
Avail: NTIS HC $10.50

A compact ion source of polarized protons and deuterons has been constructed for the high voltage terminal of a pressurized 6-MeV Van de Graaff accelerator. The source is of the atomic beam type. The major difficulty of pumping the source adequately was overcome by using three modified wire-fed titanium sublimation pumps. To conserve power, permanent magnets are used whenever possible, such as in the sextupole separation magnet and in the RF transition magnets. A rotatable Wein filter is also included to permit complete versatility in precessing the spin quantization axis to any orientation at any one of the beam line assemblies. During the recent installation of the source in the high voltage terminal, the vector and tensor polarization of the extracted deuteron beam was measured. Author (NSA)

N72-26632# Tokyo Univ. of Education (Japan). Dept. of Physics.
A LAMB-SHIFT POLARIZED ION SOURCE WITH SPIN FILTER **c24**
J. Sanada, T. Mikumo, K. Katori, S. Seki, Y. Tagishi, Y. Nojiri, S. Kobayashi (Kyoto Univ.), and H. Sakaguchi (Kyoto Univ.) *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 269-272 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

The present status of the Lamb shift polarized ion source with spin filter is described. Some improvements on the parts of the apparatus have been made. Typical beam characteristics are the following: the beam intensity is around 100 nA and the highest polarization obtained is 50 percent. Author (NSA)

N72-26633# Los Alamos Scientific Lab., N.Mex.
LAMPF H(MINUS) ION SOURCE DEVELOPMENT
Paul W. Allison and C. Robert Emigh *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 273-275 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

An accelerator is developed that has three separate 750-kV injectors, one each for protons, negative H ions, and polarized ions. The linac accelerates both positive and negative ion beams simultaneously, and by magnetic separation at the end of the linac there are two essentially independent 800-MeV beams. The negative H beam is used as a primary beam in nucleon physics experiments, and its intensity cannot be as high as the 17-mA proton beam. At the linac the beam must be focused to 5 mm diameter. An initial model of the negative hydrogen source has been built and is being tested. Author

N72-26634# Oxford Univ. (England). Nuclear Physics Lab.
THE INFLUENCE OF EXTRACTION GEOMETRY ON A NEGATIVE HELIUM ION SOURCE WITH AN EXPANDED PLASMA
T. J. L. Greenway and H. R. M. Hyder *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 277-284 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

The intensity and shape of a beam of positive helium ions extracted from a duoplasmatron have been measured as the dimensions of the plasma expansion cup and extraction electrode were varied. The effects of the source operating parameters were also examined and an arrangement was found which yielded an intense positive ion beam with low divergence. This beam was passed through an electron donor canal using lithium vapor and the emittance of the resulting negative ion beam was measured after magnetic analysis. Author (NSA)

N72-26635# Kansas State Univ., Manhattan. Nuclear Science Lab.
THE OPERATION OF A HVEC DIODE ION SOURCE FOR THE INJECTION OF NEGATIVE IONS INTO THE KSU TANDEM VAN DE GRAAFF ACCELERATOR
G. W. Hartnell, J. C. Legg, J. R. Macdonald, and G. G. Seaman *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 285-287 ref (See N72-26593 17-25) (Contract AT(11-1)-2130)
Avail: NTIS HC $10.50

The successful operation is reported of the HVEC diode ion source as the sole injector of negative heavy ions into the tandem Van de Graaff accelerator. Small but important changes in the construction of the source have been made in order to improve the reliability and stability of operation. Using the diode source for injection of either elemental or radical negative ions, adequate beams have been accelerated of various isotopes of H, C, N, O, F, Si, S, Cl, and Br. Attempts to accelerate Li, B, and P have been unsuccessful using the diode source. Author (NSA)

N72-26636# Tokyo Shibaura Electric Co., Ltd. (Japan). Electrical and Nuclear Engineering Lab.
DIRECT EXTRACTION NEGATIVE ION SOURCE FOR THE TANDEM ACCELERATOR **c11**
Seizo Masuda *In* BNL Proc. of the Symp. on Ion Sources and

Formation of Ion Beams Oct. 1971 p 289-294 refs (See N72-26593 17-25)
Avail: NTIS HC $10.50

The 10 MeV tandem accelerator at the University of Tokyo went into operation in 1967 and is now used for studies in nuclear structure. Between 1965 and 1969, several minor modifications were made and in early 1970, the old negative ion source was replaced by a new ion source. A detailed description of a direct extraction negative ion source for it is given together with a negative ion beam injection system. Author (NSA)

N72-26637# Wisconsin Univ., Madison.
NEGATIVE ION SOURCES FOR THE UNIVERSITY OF WISCONSIN'S TANDEM ACCELERATOR c11
H. T. Richards *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 295-297 refs
Sponsored in part by AEC (See N72-26593 17-25)
Avail: NTIS HC $10.50

Since 1966 a Cs charge exchange source has provided microampere beams of He(-) ions. A local version of the direct extraction source has supplied H(-), D(-), C(-), NH2(-), F(-), Cl(-), S(-) beams for injection into the tandem accelerator. The operating experience with these sources and certain of their special features are reported. Also, development work on the duodehcatron source (which replaces the filament of the direct extraction source with a hollow cathode arc in argon gas) and a Li(-) source is reported. Author (NSA)

N72-26638# Joint Publications Research Service, Arlington, Va.
ELECTRIC DISCHARGE SHOCK TUBE AS A PLASMA SOURCE FOR MAGNETOHYDRODYNAMIC EXPERIMENTS
A. M. Maksimov 26 Jun. 1972 9 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur, Akad. Nauk SSR (Moscow), v. 9, no. 5, 1971 p 1023-1028
(JPRS-56352) Avail: NTIS HC $3.00

An investigation of the parameters of a shock-heated gas in a diaphragmless electric discharge shock tube are discussed for the initial pressure range of 0.5 to 5 mm Hg and the Mach number range M = 6 to 13. The velocity of the wake of the plasma, the gas pressure, the thermal flux to the wall of the shock tube, and the extent of the plug were measured. It was demonstrated that in the investigated region the Rankine-Hugoniot equations can be used to calculate the properties of the gas flow. The process of ionization relaxation beyond the shock wave front was studied. Experiments were performed to study the interaction of the plasma flux with crossed electric and magnetic fields. Author

N72-26639# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
INFLUENCE OF LIMITERS ON THE PENETRATION OF AN OSCILLATING AXIAL CURRENT IN A STRAIGHT DISCHARGE
I. R. Jones, J.-M. Peiry, and F. Troyon Apr. 1972 21 p refs
(LRP-41/72) Avail: NTIS HC $3.25

Schemes of dynamic stabilization of pinches which relay on oscillating magnetic fields transversely to the main static field are discussed. Severe difficulties caused by the screening of the field by residual plasma are described. It is shown that insulating limiters, regularly placed along a column, suppress the screening effect by exciting stationary Alfven waves, and allow the axial oscillating current to flow on the central plasma core. Author

N72-26640*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPERATING FEATURES OF AN ION-CYCLOTRON-WAVE PLASMA APPARATUS RUNNING IN THE RF-SUSTAINED MODE
Clyde C. Swett 1972 9 p refs Presented at 1st Topical Conf. on RF Plasma Heating, Lubbock, Texas, 6-8 Jul. 1972
(NASA-TM-X-68090) Avail: NTIS HC $3.00 CSCL 20I

An experimental study has been made of an ion-cyclotron-wave apparatus operated in the RF-sustained mode. This is a mode in which the Stix RF coil both propagates the waves and maintains the plasma. Problems associated with this method of operation are presented. Some factors that are important to the coupling of RF power are noted. In general, the wave-propagation and wave-damping data agree with theory. Some irregularities in wave fields are observed. Maximum ion temperature is 870 eV at a density of 5 times 10 to the 12th power per cubic centimeter and RF power of 90 kW. Coupling efficiency is 70 percent. Author

N72-26641*# National Aeronautics and Space Administration, Washington, D.C.
SHOCK WAVES IN AN ANISOTROPIC PLASMA Ph.D. Thesis - Technische Univ., Brunswick, West Ger.
F. M. Neubauer Jun. 1972 138 p refs Transl. into ENGLISH of "Stosswellen in einem Anisotropen Plasma" Brunswick, Mar. 1969
(NASA-TT-F-709) Avail: NTIS HC $3.00 CSCL 20I

The shock wave relationships for an anisotropic plasma with magnetic field are derived for the nonrelativistic case and discussed in detail. Only the relationships existing between the magnitudes on either side of the shock wave are considered. The conservation equations are derived via several stages from the basic equations of Klimontovich and Dupree. Theories on the structure of shock waves in an anisotropic plasma, observations acquired from the earth's shock wave, and other physical considerations are used to justify the assumption of the existence of an isotropic plasma in the rear of the shock wave region. The final shock wave relations derived are discussed in terms of their implications under a variety of mathematical and physical aspects. D.L.G.

N72-26642# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
MEASUREMENTS OF BROAD BAND ELECTRIC FIELD CORRELATIONS IN A TURBULENT PLASMA Ph.D. Thesis
William R. Wing Jan. 1972 133 p refs Sponsored by AEC
(TID-25947) Avail: NTIS

A very broad-band, high-resolution correlator was built using sampling techniques. It was used in conjunction with high-temperature, impedance-matched probes to measure the rr component of a fluctuating electric field correlation tensor, in a turbulent mirror plasma device. Good agreement was found between the measured correlation and one of several calculated on the basis of different models of the instability driving the turbulence. Author (NSA)

N72-26643# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
FUNDAMENTAL STUDIES OF TURBULENT HEATING OF A PLASMA Annual Progress Report, 1 Apr. 1971 - 31 Mar. 1972
31 Mar. 1972 22 p refs
(Contracts AT(30-1)-3958; N00014-67-A-0077-0002)
(COO-3165-1) Avail: NTIS

The measurements of ion energy distribution and isotropy, made with three different analyzers, all having dual channels are presented. Microwave scattering has provided information on the spectrum of turbulence, from which new details of turbulent heating were learned. The addition of far-infrared scattering during the coming year will extend the frequency and wave number spectra. Some interesting features of turbulent heating related to the spectrum of turbulence include anomalous resistivity, plasma transport, and the ion energy distribution. These features are also measurable independently in the experiment. Magnetic probes, a conductivity probe, a voltage-divider probe, and Rogowski loops are used to obtain the resistance. A Faraday cup and the conductivity probe determine the radial distribution as a function of time. A diamagnetic loop and an energy analyzer for charge-exchange neutrals determine the plasma heating and ion energy distribution as a function of time. Author (NSA)

N72-26644# Princeton Univ., N.J.
INVESTIGATION OF ION WAVES
J. M. Dawson, W. L. Kruer, and B. Rosen Feb. 1972 18 p refs Presented at the Intern. Symp. on Dyn. of Ionized Gases, Tokyo, Sep. 1971
(Contract AT(30-1)-1238)
(MATT-883; Conf-710921-3) Avail: NTIS

Investigations of (1) the nonlinear behavior of ion waves, (2) the growth and saturation of the ion-acoustic instability, and (3) the interaction of holes in the electron phase space with ions on a one-dimensional numerical plasma model are reported. For the nonlinear behavior of ion waves, a number of different effects were examined and analyzed. The steepening and breaking of an initial sinusoidal wave were considered. The growth of the ion acoustic instability was found to be in agreement with linear theory. Its saturation level was found to be determined by the energy released when electrons became trapped by the ion waves and a simple theory for it is given. Finally, it was found that holes in the electron phase space can interact strongly with ions and that there can be an appreciable anomalous resistance associated with them. Author (NSA)

N72-26645# Institut fuer Plasmaphysik G.m.b.H., Garching (West Germany).
PERFORMANCE OF MHD GENERATOR WITH RESPECT TO IONIZATION INSTABILITY AND OTHER DETRIMENTAL MECHANISMS
H. Zinko May 1971 40 p refs In GERMAN; ENGLISH summary
(IPP-IV-19) Avail: AEC Depository Libraries

The behavior of alkali metal-rare gas plasmas was investigated with allowance for the stated loss mechanisms. The following gas mixtures were considered: Ar-K, Ar-Cs, Ne-Cs, and He-Cs. The electric power density and the specific power per meter are represented as functions of the alkali concentration, pressure and temperature in the reactor, Mach number, and polytropic efficiency. From these calculations it is possible to derive upper limits for the reactor pressure. This critical pressure region is checked by calculating MHD ducts of constant Mach number and comparing the thermal efficiencies that can be achieved with them in various types of power plants. Author (NSA)

N72-26646# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
PLASMA WAVE ECHOES
C. Etievant Sep. 1971 32 p refs Presented at 10th Intern. Conf. on Phenomena in Ionized Gases, Oxford, 13 Sep. 1971
(EUR-CEA-FC-614; Conf-710920-11) Avail: AEC Depository Libraries

Work done in connection with experiments on electron and ion plasma wave echoes is reviewed. The limitation of the perturbation theory is discussed and the saturation of echoes is explained using a more accurate model. Experimental results demonstrating the main features of both electron and ion plasma wave echoes and the effect of relaxation are presented. NSA

N72-26647# United Kingdom Atomic Energy Authority, Culham (England).
A LARGE DIAMETER Q-MACHINE PLASMA SOURCE WITH A ROTATIONALLY SYMMETRIC TEMPERATURE PROFILE
J. Burt and P. E. Stott Jul. 1971 13 p refs
(CLM-R-110) Avail: AEC Depository Libraries; HMSO 15p; PHI $0.75

The design and construction of a large-diameter Q-machine source for lithium and other alkali metal plasmas are described. In order to minimize plasma losses due to endplate temperature asymmetries, the plate is uniformly heated by electron bombardment from a rotating cathode. Author (NSA)

N72-26648# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics and Fusion Research.
ON THE BALANCE OF PLASMAS PENETRATED BY NEUTRAL GAS
B. Lehnert Feb. 1972 26 p refs
(TRITA-EPP-72-05) Avail: NTIS HC $3.50

An analysis is given of neutral gas penetration in permeable plasmas in Tokamaks, based on a model for particle momentum and heat balance. In a steady state, there is essentially a fast and a slow neutral gas component present in the interior of such plasmas. The corresponding neutral gas densities are related to the plasma balance and provide an independent method of estimating the plasma diffusion rate. The neutral gas densities calculated from the observed energy containment time agree with the observed density values. This supports conclusions that the energy losses in Tokamaks are mainly due to anomalous plasma diffusion. The observed radial pressure distribution has steep gradients in the near-wall regions; this agrees with the present theoretical model. It is suggested that the change in behavior of Tokamaks near this limit is associated with the transition from permeable to impermeable plasma conditions. Author (ESRO)

N72-26649# European Space Research and Technology Center, Noordwijk (Netherlands).
AN ELECTROACOUSTIC METHOD OF MEASURING DRIFT AND TEMPERATURE IN PLASMAS
R. J. L. Grard Paris ESRO Jul. 1969 32 p refs
(ESRO-SN-103-ESTEC) Avail: NTIS HC $3.75

The properties of electroacoustic waves generated by a point charge immersed in a drifting plasma are presented. The propagation of signals in the electroacoustic mode was observed. The results pertain to the case where the drift velocity is higher than the ion wave velocity, but yield information on electron temperature and the bulk motion of the plasma. This diagnostic technique could possibly be used for measurements made on the ionospheric plasma conducted on board an artificial satellite or sounding rocket. Author (ESRO)

N72-26650# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics and Fusion Research.
ON THE STABILITY OF PLASMAS PENETRATED BY NEUTRAL GAS
B. Lehnert 2 Apr. 1972 33 p refs
(TRITA-EPP-72-06) Avail: NTIS HC $3.75

The stability of ballooning and flute modes of a low beta plasma penetrated by neutral gas is discussed in terms of a simple localized perturbation analysis. The theory is restricted to equilibria without any essential fluid motions, and to pressures of the surrounding neutral gas not necessarily comparable to that of the plasma. The main effects on stability studied are due to the neutral drag force on the center of mass of the plasma fluid elements, to finite resistivity, and to the plasma and neutral gas viscosity. The results are illustrated by examples of permeable plasmas, such as those in Tokamaks, and the partially ionized boundary region of impermeable plasmas. Author (ESRO)

N72-26651# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIAL INJECTION OF SEVERAL PLASMOIDS
G. Ya. Umarov and A. K. Alimov 11 Dec. 1971 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk Vz. SSR, Ser. Fiz. Mat. Nauk (Tashkent), v. 11, no. 6, 1967 p 74-75
(AD-738740; FTD-HT-23-797-71) Avail: NTIS CSCL 20/9

High speed photography was used to study the processes of the simultaneous injection of several plasmoids into a vacuum chamber containing 0.05-0.1 mm Hg of hydrogen from five coaxial electrodynamic guns which were fed through a specially prepared cable and a spherical discharger from 6 IM 50-3 type condensers with a capacitance of 18 mu F connected in parallel. Author (GRA)

N72-26652# Maryland Univ., College Park. Dept. of Physics and Astronomy.
PRODUCTION OF THERMONUCLEAR PLASMAS BY

ANOMALOUS DIFFUSION OF MAGNETIC FIELDS IN A HIGH VOLTAGE THETA PINCH Annual Summary Report, Nov. 1970 - Nov. 1971
Nov. 1971 63 p refs
(Contract N00014-67-A-0239-0015; NR Proj. 099-395)
(AD-738870) Avail: NTIS CSCL 20/9

The report describes work being performed at the University of Maryland on understanding collisionless dissipation mechanisms, which are operative when a large-amplitude magnetic pulse is applied to a low density magnetized plasma. The experimental device is described in the report presented at the IAEA Novosibirsk meeting in 1968. During the present reporting period, emphasis was on understanding the details of instabilities occurring in the fast theta-pinch device, and on acquiring measurements of quantities, such as fluctuating electric fields and ion particle distributions, that could be compared to theory. Author (GRA)

N72-26653# Naval Research Lab., Washington, D.C.
FLUID MODELS FOR TOKAMAK PLASMAS Final Report
Diethelm Duechs 22 Feb. 1972 41 p refs
(AD-738821; NRL-7340) Avail: NTIS CSCL 20/9

The Tokamak system is a toroidal electromagnetic field plasma configuration in which the magnetic field ratio B sub z/B sub theta is large. This toroidal configuration, which is one of the simpler magnetic confinement geometries, has led to relatively high plasma temperatures, densities, and containment times. The growing amount of experimental data, which needs to be explained, reveals the need for complicated theoretical plasma models similar to those which have been applied to pinch plasmas over the past several years. It does not seem possible to explain the experimental data by using the present two-fluid model applying the usual (classical) transport coefficients. Two major model expansions are obvious: (a) increase the number of fluids in the model, and (b) take into account as many spatial dimensions as possible. A fluid model that includes neutrals, electrons, and ions with arbitrary charge Z is derived. Cylindrical symmetry is imposed, although the transport coefficients include corrections for toroidal geometry. Assumptions are discussed under which this model can be applied to describe a Tokamak plasma consisting of neutral hydrogen, protons, electrons, and nine ionization stages of oxygen impurities. Author (GRA)

N72-26654# General Electric Co., Philadelphia, Pa. Space Div.
ELECTRODE EFFECTS AND GAS DYNAMIC CHARACTERISTICS OF A LARGE, NONEQUILIBRIUM MHD GENERATOR WITH CESIUM SEEDED, NOBLE GASES
B. Zauderer and E. Tate Mar. 1972 36 p refs
(Contract N00014-70-C-0321)
(AD-738495; Rept-72SD209; ONR-TR-1815) Avail: NTIS CSCL 20/9

An experimental study was performed to determine the factors limiting the power output of a linear, supersonic Faraday generator, having electrodes suspended in the gas flow. The test gases were cesium seeded neon or argon at 2000 to 4000 degrees K stagnation temperatures and 5 to 11 MW thermal power levels. It was observed that the electrode current varies directly with the cesium concentration for electrode current densities of the order of tens of amp/sq cm. The electrode current was nearly independent of electrode temperature and surface area. It was concluded that the electrode conduction was due to the cesium ion flux at the cathode. The gas dynamic characteristics of the generator as deduced from pressure and Mach number measurements were in fairly good agreement with the theory based on the one dimensional gas conservation equations. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N72-26655*# Rensselaer Polytechnic Inst., Troy, N.Y. Materials Div.
POLYMER CRYSTALLIZATION IN A TEMPERATURE GRADIENT FIELD WITH CONTROLLED CRYSTAL GROWTH RATE
David Hansen, Ajay N. Taskar, and ONeil Casale Sep. 1971 15 p refs Sponsored by NASA
(NASA-CR-127056) Avail: NTIS HC $3.00 CSCL 20B

A method is described for studying the influence of a temperature gradient on the crystallization of quiescent polymer melts. The apparatus used consists of two brass plates with embedded electrical resistance heaters and cooling coils. The crystallizations experiments were conducted by placing polymer specimens between the plates, and manually adjusting heaters and cooling fluids for temperature control. Linear polyethylene, isotactic polyprophylene, and a high density polyethylene were used. It is concluded that the role of a temperature gradient in producing oriented crystallization is in producing conditions which lead the spherulitic growth pattern to proceed primarily in one direction. Steep gradients diminish the penetration of supercooling and favors oriented growth. F.O.S.

N72-26656# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Energiewandlung und Elektrische Antriebe.
ENERGY STORAGE IN SUPERCONDUCTING COILS
C. Carpetis 6 Mar. 1972 59 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-10) Avail: NTIS HC $5.00; DFVLR Porz-Wahn; 20, DM

The storage of energy in superconducting coils and the capital costs of such a practice are discussed. The field intensity in the coil, the current density of the superconductor, and a characteristic dimension of the coil are related to the geometry of coil and the energy stored in it. Such data allows optimization of the coil with respect to its specific mass. A comparison of the superconducting coil with other energy storage systems revealed that the superconducting systems are characterized by relatively low specific mass and low capital costs, especially where high discharge power is required. Author

N72-26657# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Werkstoff-Forschung.
EFFECT OF PLASTIC DEFORMATION ON THE AGE-HARDENING OF AlCuMg 1, AlCuMg 2 AND AlZnMgCu 0,5
Y. Takeuchi 1971 40 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-91) Avail: NTIS HC $4.00; DFVLR, Porz-Wahn: 14, 80 DM

The effect of a tension load up to a plastic deformation of about 3% on age hardening at room temperature was investigated.The study was made by measuring the mechanical properties and the electrical resistance of wires of AlCuMg, AlCuMg2 and AlZnMgCu(0.5). It was found that an elastic stress does not effect the formation of zones in the tested alloys; a clear effect of load is only observed if plastic deformation - caused by the load - exceeds 0,1 %. A model is suggested to explain the results, based on the interaction between complexes of alloy interstitial atoms/vacancies, existing at the beginning of the age hardening at room temperature, and the dislocations caused by the plastic deformation. Author

N72-26658# National Bureau of Standards, Boulder, Colo. Quantum Electronics Div.
LONGITUDINAL MAGNETORESISTANCE IN POLAR SEMICONDUCTORS
Robert L. Peterson Apr. 1972 47 p refs
(NBS-TN-614) Avail: SOD $0.50 as C 13.46:614

The magnetophonon effect due to resonant interactions of charge carriers with optical phonons in nondegenerate polar semiconductors is studied when several elastic scattering mechanisms are simultaneously active also. The simple model of the band structure, and the displaced Maxwellian distribution function are used. Analytical expressions for drift mobility are given for B = 0 and the quantum limit, and are compared with the results of other techniques where possible. The numerical calculations show that whenever magnetophonon oscillations are seen in the ohmic regime, maxima occur near the resonance magnetic fields for all lattice temperature and strengths of scattering mechanisms which compete with the optical phonon scattering. This is in contrast with typical experimental findings, in which minima usually (but not always) appear near the resonance fields for ohmic, longitudinal, conditions. Author

N72-26659# Joint Publications Research Service, Arlington, Va.
EFFECT OF THE RADIATION STABILITY OF SEMICONDUCTORS WITH STOICHIOMETRIC VACANCIES
V. M. Koshkin and L. P. Galichinetskiy 15 Jun. 1972 5 p refs
Transl. into ENGLISH from Fiz. Tverd. Tela (Leningrad), v. 14, no. 2, Feb. 1972 p 646-648
(JPRS-56287) Avail: NTIS HC $3.00

This report studies single-crystal and polycrystalline reaction to irradiation with gamma quanta, fast electrons, fast neutrons in a pulse reactor, and mixed reactor radiation under steady-state conditions. Author

N72-26660# Joint Publications Research Service, Arlington, Va.
VARIETIES OF SEMICONDUCTOR MATERIALS
20 Jun. 1972 53 p refs Translated into ENGLISH from Poluprov. Prib. Ikh Primen., Sb. Statei (Moscow), no. 25, 1971 p 267-298 and from Elektron. i yeye Primeneniye (Moscow), 1971 p 247-265
(JPRS-56307) Avail: NTIS HC $4.75

A survey is presented of technological advancements relating to the development of semiconductor nuclear radiation detectors and the synthesis of dissociating semiconductor compounds. For individual titles, see N72-26661 through N72-26662.

N72-26661# Joint Publications Research Service, Arlington, Va.
SEMICONDUCTOR NUCLEAR RADIATION DETECTORS
c14
S. M. Ryvkin, O. A. Matveyev, S. R. Novikov, and N. B. Strokan *In its* Varieties of Semicond. Mater. 20 Jun. 1972 p 1-30 refs (See N72-26660 17-26)
Avail: NTIS HC $4.75

The technology associated with the development of semiconductor counters is reviewed along with the problems arising during the design, preparation, and investigation of these detectors. Primary emphasis is placed on the central problems that concern specific characteristics of counters and their related processing aspects, along with the required properties of the initial materials. The basic task facing detector manufacturers are examined, and means for their solution are proposed. D.L.G.

N72-26662# Joint Publications Research Service, Arlington, Va.
RECENT DEVELOPMENTS IN THE SYNTHESIS OF DISSOCIATING SEMICONDUCTOR COMPOUNDS
Ya. M. Nashelskiy and V. M. Grachev *In its* Varieties of Semicond. Mater. 20 Jun. 1972 p 31-50 refs (See N72-26660 17-26)
Avail: NTIS HC $4.75

A literature survey is presented of studies related to the synthesis of dissociating semiconductor compounds, or their solid solutions, which display a high vapor pressure by the compound itself or its constituents during melting. Numerous problems encountered by process engineers in the synthesis of these compounds are reviewed. Particular emphasis is placed on the problems involved in growing highly pure gallium arsenide single crystals, having an ideal structure, and compounds with a very wide forbidden band. D.L.G.

N72-26663# California Univ., Berkeley. Lawrence Berkeley Lab.
APPLICATION OF POWDER METALLURGY PROCESS IN THE FORMATION OF Nb3Al SUPERCONDUCTOR M. S. Thesis
Thomas Tom Dec. 1971 26 p refs
(Contract W-7405-eng-48)
(LBL-188) Avail: NTIS

The effects of process variables on the critical temperature of Nb3Al were studied by the utilization of a powder metallurgy process. The preparation technique consisted of roll compaction of niobium powder, sintering the strip and infiltration of aluminum into the sintered strip. A heat treatment at 1530 C gave T sub c values of 16.95 to 17.45 K. Two-step heat treatments gave T sub c values of 11.39 to 18.27 K. The critical temperature of all samples were increased by annealing at 750 C for 18 hours. Author (NSA)

N72-26664# Atlantic Richfield Hanford Co., Richland, Wash.
ZERO DISPLACEMENT, LIQUID NITROGEN LEVEL MONITOR FOR SEMICONDUCTOR DETECTORS
William H. Zimmer Jan. 1972 19 p refs
(Contract AT(45-1)-2130)
(ARH-2247) Avail: NTIS

Lithium-drifted germanium Ge(Li) and lithium-drifted silicon Si(Li) detectors are operated at liquid nitrogen temperatures. If the detector is warmed while the bias voltage is applied, the detector is destroyed. Proper use of a strain gage to monitor the liquid nitrogen in semiconductor detector assemblages constitutes the least expensive system that does not induce statistically significant detector-sample displacement, monitors continuously, reads directly and linearly in units of liquid nitrogen volume or weight, provides a signal which can trigger an alarm, does not use liquid nitrogen to operate, and is fail-safe. Any measurement system component failure will cause an alarm. Author (NSA)

N72-26665# Northwestern Univ., Evanston, Ill.
ANALYTICAL STUDY ON DISLOCATIONS IN THIN FILMS Final Report
T. Mura [1972] 4 p refs
(Contract AT(11-1)-2034)
(COO-2034-7) Avail: NTIS

The results of research on dislocations in thin films are summarized. The topics covered include: (1) dislocation pile-up in half-space, (2) dislocation stresses in a thin film due to the periodic distributions of dislocations, (3) elastic fields of inclusions in anisotropic media, and (4) Green's function for anisotropic elasticity. D.L.G.

N72-26666# Interuniversitair Reactor Instituut, Delft (Netherlands).
ICPEAX, A COMPUTER PROGRAM FOR THE AUTOMATIC ANALYSIS OF GAMMA RAY SPECTRA OBTAINED WITH HIGH RESOLUTION SEMICONDUCTOR DETECTORS
P. J. M. Korthoven [1970] 43 p refs
(IRI-133-70-04) Avail: NTIS HC $4.25

The program ICPEAX is a computer program for the automatic analysis of gamma ray spectra obtained with high resolution semiconductor detectors. The peaks are located by inspection of the smoothed second and third derivatives of the spectrum. The smoothing depends on the average peak width. A region of the peak is then fitted with a Gaussian function with a nonlinear least squares method. The limits of this region are determined by the quality of the detector response. From the peak parameters the area and energy of all peaks are calculated.

Error estimates for these quantities are also given.
Author (ESRO)

N72-26667# Finnish Academy of Technical Sciences, Helsinki.
ELECTRICAL CONDUCTION AND SWITCHING IN CHALCOGENIDE THIN FILMS
Tuomo Suntola (Helsinki Univ. of Tech.) 1971 41 p refs
(PB-207206; APS-PH-82) Avail: NTIS HC $3.00; Acta Polytech. Scand. Publishing Office, Box 5073, Stockholm 5, Sweden: SW KR 10.00 CSCL 20L

The conduction mechanism and switching effect in chalcogenide thin films have been studied using vacuum evaporated sandwich samples with Te(x)Ge(1-x) and Te(50)As(30) Ge(10)Si(10) composition. The main experimental work done on the conduction mechanism consists of studies on high field effects which are of considerable importance in the switching effect especially in thin samples. The Poole-Frenkel emission and tunneling from traps to conduction and valence bands have been analyzed using the energy band model by Cohen, Fritzsche and Ovshinsky. The switching effect has been explained as an electrothermal instability. The distributions of temperature, electric field and current density have been calculated taking into account the field dependence of the current.
GRA

N72-26668# Wesleyan Univ., Middletown, Conn.
STUDIES OF SOLID HELIUM BELOW 1.0 K Final Report, 1 Feb. 1969 - 31 Jan. 1972
Louis N. Y. Shen and John U. Trefny Feb. 1972 6 p refs
(Contract DA-ARO(D)-31-124-G1092; DA Proj. 200-61102-B-11-B)
(AD-738595; AROD-7957:5-P) Avail: NTIS CSCL 20/12

The report provides a summary of the research results obtained. The primary thrust of the work has been the development and application of heat pulse techniques to the study of condensed helium. Extensive work has been done on liquid He4 and on single crystals of He4. In the latter, diffusive, second-sound and ballistic modes of heat propagation have been observed and analyzed in terms of intrinsic properties of the system. This work has led to new information about solid helium, and has also revealed instrumental and interpretational subtleties associated with the heat pulse techniques used.
Author (GRA)

N72-26669# Hewlett-Packard Co., Palo Alto, Calif.
MAGNETIC RARE EARTH COMPOUNDS Semiannual Technical Report, 14 Jun. - 14 Dec. 1971
Robert A. Burmeister and Ronald Hiskes Feb. 1972 71 p refs
(Contract DAAH01-71-C-1259; ARPA Order 1627)
(AD-738537) Avail: NTIS CSCL 20/2

Magnetically uniaxial rare earth garnets, such as EuEr2Ga(0.7) Fe(4.3O12 and Y(1.3)GdYb(0.7)Fe(4.1)Ga(0.9)O12, have been grown by quasi steady-state (isothermal) liquid phase epitaxial techniques. The epitaxial layers have been grown on Syton polished (111) Gd3Ga5O12 substrates by the dipping technique in which the substrates, fastened to a platinum holder, are dipped into the supersaturated growth solution. Both PbO-B2O3 and BaO-B2O3-BaF2 solvents have been employed for the crystal growth, since each has certain distinct advantages and disadvantages for this type of growth situation. The BaO-based solvent has been characterized, and a solubility curve for a typical garnet, EuEr2Ga(0.7)Fe(4.3)O12, has been experimentally determined. The magnetic films have been characterized with respect to solvent content and distribution coefficients of the constituent ions for each of the growth solutions, lattice parameter mismatch between epitaxial layer and substrate, and magnetic properties.
GRA

N72-26670# Watervliet Arsenal, N.Y.
MATHEMATICS OF ELECTRONIC BAND STRUCTURE CALCULATIONS FOR LATTICES WITH MORE THAN ONE ATOM PER PRIMITIVE CELL. PART 2: APPLICATION TO THE Cu3Au STRUCTURE
Donald M. Gray Nov. 1971 52 p refs
(DA Proj. 1T0-6110-A-91A)
(AD-738556; WVT-7163-Pt-2) Avail: NTIS CSCL 20/12

In the first report of the series the authors outlined a general procedure for the calculation of electronic band structures. In the present report it is shown how to apply this procedure to the Cu3Au structure. Unsymmetrized and symmetrized trial expansion functions are given and the appropriate integrals are constructed for both the Modified Plane Wave and the Modified Orthogonalized Plane Wave methods. A muffin-tin type potential is used. Diagonalization of the resultant matrices to obtain the final crystal energy levels is discussed. Brief comments are given concerning results of the application of the procedure to Cu3Au and LaSn3.
Author (GRA)

N72-26671# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
INDUCED FLUX FLOW NOISE WITH TYPE 2 SUPERCONDUCTORS, PART 2 Final Report
H. M. Choe and A. vanderZiel Feb. 1972 32 p refs
(Contract N00014-67-A-0113-0010; NR Proj. 319-011)
(AD-738497) Avail: NTIS CSCL 20/3

Flux-flow noise in type II superconductors is studied with the help of pick-up coils. The observed noise can be qualitatively explained as magnetic coupling between the (primary) superconducting foil and the pick-up coil, but for a quantitative explanation the motion of the individual fluxoids in the primary foil must be taken into account. The correlation between the noise signals induced in two separate pick-up coils is also studied.
Author (GRA)

N72-26672# Oregon State Univ., Corvallis. Dept. of Chemistry.
DIELECTRIC RELAXATION IN CRYSTALLINE V2O5
Allen B. Scott and Kenneth M. Mar 29 Feb. 1972 16 p refs
(Contract N00014-67-A-0369-0008; NR Proj. 359-446)
(AD-738474; TR-5) Avail: NTIS CSCL 20/12

The real part of the dielectric constant in crystalline V2O5 has been measured in the temperature range 80 K to 200 K. It rises from about 5, at low temperature, to about 9 in a narrow temperature range which depends upon frequency. The ac conductivity exceeds the dc conductivity by a measurable amount at low temperature, because of the contribution of relaxation. The crystal behaves approximately as a Debye dielectric. The relaxation time was found as a function of temperature. Two models for dipolar centers are proposed and discussed.
Author (GRA)

N72-26673# Stanford Univ., Calif. Center for Materials Research.
SYNTHESIS OF COMPOUND SEMICONDUCTING MATERIALS AND DEVICE APPLICATIONS Semi-Annual Technical Report, 1 Jul. - 31 Dec. 1971
D. A. Stevenson, R. H. Bube, R. S. Feigelson, G. S. Kino, B. L. Mattes, W. D. Nix, R. K. Route, and W. A. Tiller 31 Dec. 1971 104 p refs
(Contract DAHC15-71-G-9; ARPA Order 1644)
(AD-738470; CMR-72-2) Avail: NTIS CSCL 20/12

The present program concerns the synthesis of compound semiconducting materials, with particular emphasis on their use in planar microwave devices. The program consists of three major sections: thin film epitaxial growth of III-V compounds; device design, fabrication and evaluation; and fundamental studies of crystal synthesis and properties. The devices of primary interest are of the planar microwave and acoustical type, employing thin films of GaAs as the active layer. The topics include: observations of precipitation effects in GaAs by transmission electron microscopy; measurement of electrical property changes in GaAs induced by changes in dislocation density; and a theoretical analysis of the GaAs/liquid gallium interface.
Author (GRA)

N72-26674# Stanford Univ., Calif. Center for Materials Research.
RESEARCH ON AMORPHOUS MATERIALS Semiannual Technical Report, 1 Jul. - 31 Dec. 1971
W. E. Spicer, A. Bienenstock, and R. H. Bube 31 Dec. 1971 112 p refs
(Contract DAHC04-70-C-0044; ARPA Order 1562)
(AD-738467; CMR-71-24) Avail: NTIS CSCL 20/12

Contents: The density of states of crystalline and amorphous Ge and Si; Photoemission investigation of amorphous Si and Ge; Investigation of the band edges of amorphous Ge and Si; Impurity electrons in amorphous Germanium a photoemission argument for the Mott model; UV dielectric constants of a-Ge as a function of film density; Photoemission investigation of amorphous Germanium; Electronic structure of amorphous and polycrystalline GeTe; Calculation of the intercrystalline interference contribution to the scattering of X-rays by arrays of small crystallites; Neutron and X-ray diffraction radial distribution studies of amorphous Ge(.17)Te(.83); Structure and bonding in amorphous Ge(x)Te(1-x) alloys; Radial distribution studies of glassy Ge(x)S(1-x) alloys; Analysis of photoconductivity in amorphous chalcogenides. GRA

N72-26675# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
TWINNING IN NIOBIUM, A CONTINUOUS NUCLEATION THEORY Final Technical Report, 1 Feb. - 31 Jan. 1972
B. J. Shaw 1 Mar. 1972 33 p refs
(Contract Nonr-4442(00); NR Proj. 039-085)
(AD-738496; Rept-69-9J7-119-R1) Avail: NTIS CSCL 20/2

The energy required to form a twin in Nb has been experimentally determined to be of the order 1 billion ergs/cc. This high energy has been explained in terms of a continuous nucleation theory which also accounts for the observed morphology of twins in bcc transition metals and the heat evolved in the process. Author (GRA)

N72-26676# Stanford Univ., Calif.
SOME THEORETICAL ASPECTS OF RF SUPERCONDUCTIVITY
J. P. Turneaure Sep. 1971 11 p refs
(Contract N00014-67-A-0112-0061)
(AD-739347; SU-HEPL-659) Avail: NTIS CSCL 20/12

The work towards the development of superconducting accelerators and particle separators has led to considerable improvement in the understanding of RF superconductivity. This paper discusses present understanding of RF superconductivity with emphasis on those topics that relate to accelerating devices. Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N72-26677 Massachusetts Univ., Amherst.
A THEORETICAL STUDY OF THE COMBUSTION AND EXTINCTION OF COMPOSITE SOLID PROPELLANTS DURING DEPRESSURIZATION Ph.D. Thesis
Hukam C. Mongia 1971 204 p
Avail: Univ. Microfilms Order No. 72-645

A theoretical investigation in respect to the transient burning rate, variation of the gas-solid surface coupled processes, condensed phase heat release, and activation energy associated with gasification of the solid, and critical pressure decay rate required to cause extinction of a steadily burning composite solid propellant subject to sudden depressurization is reported. It has been shown that any model, which assumes that various processes on the gas-solid interface, and in the gas phase are quasi-steady, may correctly predict critical depressurization rate but cannot give good correlation with experiments with regard to burning rates. A new transient combustion model has been developed which correctly predicts critical depressurization rates and gives good correlation with experiments with regard to transient burning rates. Dissert. Abstr.

N72-26678*# Martin Marietta Corp., Denver, Colo.
MATERIAL COMPATIBILITY WITH SPACE-STORABLE PROPELLANTS. DESIGN GUIDEBOOK
P. E. Uney and D. A. Fester Mar. 1972 123 p refs Prepared for JPL, Calif. Inst. of Technol., Pasadena
(Contracts NAS7-100; JPL-HF-556439)
(NASA-CR-127057; MCR-72-26) Avail: NTIS HC $8.25 CSCL 21I

An important consideration in the design of spacecraft for interplanetary missions is the compatibility of storage materials with the propellants. Serious problems can arise because many propellants are either extremely reactive or subject to catalytic decomposition, making the selection of proper materials of construction for propellant containment and control a critical requirement for the long-life applications. To aid in selecting materials and designing and evaluating various propulsion subsystems, available information on the compatibility of spacecraft materials with propellants of interest was compiled from literature searches and personal contacts. The compatibility of both metals and nonmetals with hydrazine, monomethyl hydrazine, nitrated hydrazine, and diborance fuels and nitrogen tetroxide, fluorine, oxygen difluoride, and Flox oxidizers was surveyed. These fuels and oxidizers encompass the wide variety of problems encountered in propellant storage. As such, they present worst case situations of the propellant affecting the material and the material affecting the propellant. This includes material attack, propellant decomposition, and the formation of clogging materials. Author

N72-26679# Defence Standards Labs., Maribyrnong (Australia).
SOLVENT EXTRACTION OF SOME SINGLE BASE PROPELLANTS WITH DIETHYL ETHER
R. G. Davidson, K. J. Diviny, and F. D. McPherson Apr. 1972 14 p refs
(Rept-502) Avail: NTIS

The rate of extraction of soluble material by diethyl ether from some single base propellants was examined. Minor components in the extracts were identified and their effect on the bromination procedure for the determination of DPA was investigated. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N72-26680 Colorado State Univ., Fort Collins.
ION THRUSTER PROPELLANT UTILIZATION Ph.D. Thesis
Harold Richard Kaufman 1971 92 p
Avail: Univ. Microfilms Order No. 71-30032

The subject of this investigations is the evaluation and understanding of maximum propellant utilization. The primary-electron region in the ion chamber of a bombardment thruster is analyzed at maximum utilization. The results of this analysis, as well as experimental data from a range of ion-chamber configurations, show a nearly constant loss rate for un-ionized propellant at maximum utilization over a wide range of total propellant flow rate. The discharge loss level of 1000 eV/ion was used as a definition of maximum utilization, but the exact level of this definition has no effect on the qualitative results and little effect on the quantitative results. There are obvious design applications for the results of this investigation, but the results are particularly significant whenever efficient throttled operation is required. Dissert. Abstr.

N72-26681*# Rocketdyne, Canoga Park, Calif.
MODIFIED RS2101 ROCKET ENGINE STUDY PROGRAM Final Report
7 Dec. 1971 122 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953066)
(NASA-CR-127386; SER-1159/RS21/1001) Avail: NTIS HC $8.25 CSCL 21H

The purpose of the program is to perform design studies and analyses to determine the effects of incorporating a 60:1 expansion area ratio nozzle extension, extended firing time, and modified operating conditions and environments on the MM'71 rocket engine assembly. An injector-to-thrust chamber seal study was conducted to define potential solutions for leakage past this joint. The results and recommendations evolving from the engine thermal analyses, the injector-to-thrust chamber seal studies, and the nozzle extension joint stress analyses are presented. Author

N72-26682*# Princeton Univ., N.J. Guggenheim Aerospace Propulsion Labs.
MASS, MOMENTUM AND ENERGY FLOW FROM AN MPD ACCELERATOR Ph.D. Thesis
John S. Cory Sep. 1971 111 p refs
(Grant NGL-31-001-005)
(NASA-CR-127120; Rept-999) Avail: NTIS HC $7.75 CSCL 21C

The mass, momentum, and energy flows are measured over a current range of 8 to 50 kA and inlet mass flows of 2 to 36 q/sec of argon. The momentum flux profile indicates that the accelerator produces a uniform, 2-inch diameter axial jet at the anode which expands into a Gaussian profile at an axial station 11 inches from the anode. The electromagnetic component of the thrust is found to follow the familiar quadratic dependence on arc current, while a more complex empirical relation is needed to correlate the gasdynamic contribution with the current and mass flow rate. Using available time-of-flight velocity profiles at a current of 16 kA and a mass flow of 5.9 g/sec, calculated flux profiles of mass and kinetic energy exhibit a tendency for some fraction of the inlet mass flow to leak out at a low velocity around the central high velocity core. Author

N72-26683*# Aerojet Solid Propulsion Co., Sacramento, Calif.
STUDY OF SOLID ROCKET MOTOR FOR A SPACE SHUTTLE BOOSTER Final Report
15 Mar. 1972 139 p refs
(Contract NAS8-28428)
(NASA-CR-123687; Rept-1971-FR1) Avail: NTIS HC $9.00 CSCL 21H

The study of solid rocket motors for a space shuttle booster was directed toward definition of a parallel-burn shuttle booster using two 156-in.-dia solid rocket motors. The study effort was organized into the following major task areas: system studies, preliminary design, program planning, and program costing. Author

N72-26684*# Aerojet Solid Propulsion Co., Sacramento, Calif.
STUDY OF SOLID ROCKET MOTOR FOR A SPACE SHUTTLE BOOSTER. APPENDIX B: TYPICAL COMPONENT RECERTIFICATION TEST PROCEDURES Final Report
15 Mar. 1972 4 p
(Contract NAS8-28428)
(NASA-CR-123686; Rept-1971-FR1-App-B) Avail: NTIS HC $3.00 CSCL 21H

Flexseal assemblies, TVC actuators, hydraulic supply system, TVC electronic control unit, flight instrumentation system, ordnance system electronics, and hydrotest of SRM case segments are discussed, applied to typical component recertification test procedures. J.A.M.

N72-26685*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBINE DESIGN AND APPLICATION, VOLUME 1
Arthur J. Glassman, ed. Washington 1972 101 p refs
(NASA-SP-290; LC-79-185105) Avail: NTIS; SOD $0.60 CSCL 21E

Various aspects of turbine technology are discussed. The areas considered include thermodynamic and fluid dynamic concepts, fundamental turbine concepts, and velocity diagram design. For individual titles, see N72-26686 through N72-26688.

N72-26686*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMODYNAMIC AND FLUID-DYNAMIC CONCEPTS c12
Arthur J. Glassman *In its* Turbine Design and Appl., Vol. 1 1972 p 1-20 refs (See N72-26685 17-28)
Avail: NTIS; SOD $0.60 CSCL 20D

Some of the fundamental concepts of thermodynamics and compressible fluid mechanics are reviewed. The concepts treated are those that are considered necessary to analyze the flow and energy transfer processes occurring in a turbine. Author

N72-26687*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BASIC TURBINE CONCEPTS
Arthur J. Glassman *In its* Turbine Design and Appl., Vol. 1 1972 p 21-67 refs (See N72-26685 17-28)
Avail: NTIS; SOD $0.60 CSCL 21E

Turbine geometric, flow, energy transfer, efficiency, and performance characteristics are considered by the use of definitions, diagrams, and dimensionless parameters. Emphasis is placed on the determination of the fluid velocity as it passes from one blade row to the next. The general methods for constructing velocity diagrams and relating them to the work and flow capacity of the turbine are discussed. D.L.G.

N72-26688*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VELOCITY DIAGRAMS
Warren J. Whitney and Warner L. Stewart *In its* Turbine Design and Appl., Vol. 1 1972 p 69-99 refs (See N72-26685 17-28)
Avail: NTIS; SOD $0.60 CSCL 21E

The selection and design of velocity diagrams for axial flow turbines are considered. Application is treated in two parts which includes: (1) mean-section diagrams, and (2) radial variation of diagrams. In the first part, the velocity diagrams occurring at the mean section are assumed to represent the average conditions encountered by the turbine. The different types of diagrams, their relation to stage efficiency, and their selection when staging is required are discussed. In the second part, it is shown that in certain cases the mean-section diagrams may or may not represent the average flow conditions for the entire blade span. In the case of relatively low hub- to tip-radius ratios, substantial variations in the velocity diagrams are encountered. The radial variations in flow conditions and their effect on the velocity diagrams are considered. D.L.G.

N72-26689*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
SINGLE-STAGE EXPERIMENTAL EVALUATION OF TANDEM-AIRFOIL ROTOR AND STATOR BLADING FOR COMPRESSORS. PART 1: ANALYSIS AND DESIGN OF STAGES A, B, AND C
J. A. Brent, J. G. Cheatham, and A. W. Nilsen Jun. 1972 118 p refs
(Contract NAS3-11158)
(NASA-CR-120803; PWA-FR-4667-Pt-1) Avail: NTIS HC

$8.00 CSCL 21E

A conventional rotor and stator, two dual-airfoil tandem rotors, and one dual-airfoil tandem stator were designed. The two tandem rotors were each designed with different percentages of the overall lift produced by the front airfoil. Velocity diagrams and blade leading and trailing edge metal angles selected for the conventional rotor and stator blading were used in the design of the tandem blading. Rotor inlet hub/tip ratio was 0.8. Design values of rotor tip velocity and stage pressure ratio were 757 ft/sec and 1.30, respectively. Author

N72-26690*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.

SINGLE-STAGE EXPERIMENTAL EVALUATION OF TANDEM-AIRFOIL ROTOR AND STATOR BLADING FOR COMPRESSORS. PART 2: DATA AND PERFORMANCE FOR STAGE A

J. A. Brent Jul. 1972 120 p refs
(Contract NAS3-11158)
(NASA-CR-120804; PWA-FR-4719) Avail: NTIS HC $8.00 CSCL 21E

Stage A, comprised of a conventional rotor and stator, was designed and tested to establish a performance baseline for comparison with the results of subsequent tests planned for two tandem-blade stages. The rotor had an inlet hub/tip ratio of 0.8 and a design tip velocity of 757 ft/sec. At design equivalent rotor speed, rotor A achieved a maximum adiabatic efficiency of 85.1 percent at a pressure ratio of 1.29. The stage maximum adiabatic efficiency was 78.6 percent at a pressure ratio of 1.27. Author

N72-26691*# General Electric Co., Lynn, Mass. Aircraft Engine Group.

TF34 TURBOFAN QUIET ENGINE STUDY Final Report

D. P. Edkins, R. Hirschkron, and R. Lee [1971] 99 p ref
(Contract NAS3-14338)
(NASA-CR-120914) Avail: NTIS HC $7.00 CSCL 21E

A study is presented of high bypass turbofan engines in heavily sound-suppressed nacelles based on the TF-34 engine. The four-engine noise objective was 95 PNdB at four locations typical of takeoff and landing. Three engines were studied; these had fan pressure ratios, bypass ratios and fan tip speeds respectively of 1.48/6.5/404m/s (1327 ft/s),1.25/13/305 (1000), 1.25/13/366 (1200). The bypass 13 engines had a variable pitch fan, direct- and gear-driven. Noise suppressive treatment was identified which met the 95 PNdB objective except for sideline liftoff at 6.5 bypass, full power, which was 2 PNdB noisier; at 90% power, 95 PNdB was achieved. Author

N72-26692*# General Electric Co., Lynn, Mass. Aircraft Engine Group.

ACOUSTICALLY TREATED GROUND TEST NACELLE FOR THE GENERAL ELECTRIC TF34 TURBOFAN Final Report

D. P. Edkins 31 Jan. 1972 66 p
(Contract NAS3-14338)
(NASA-CR-120915) Avail: NTIS HC $5.50 CSCL 21E

A description is given of the ground test quiet nacelle for the TF34 engine. The suppression treatment consists of cylindrical splitters in the inlet and fan exhaust ducts plus duct wall treatment and core exhaust wall treatment. Aerodynamic design analysis of the inlet and exhaust ducts and overall engine performance with pressure losses from the acoustic treatment is included. The objectives of the test program are to obtain noise data for a heavily suppressed high bypass turbofan with various arrangements of exhaust systems and acoustic treatment, and to provide a basis for the power plants of the Quiet Experimental STOL Aircraft (Questol). Author

N72-26693*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

EVALUATION OF RANGE AND DISTORTION TOLERANCE FOR HIGH MACH NUMBER TRANSONIC FAN STAGES, TASK 2 Final Report

K. R. Bilwakesh, C. C. Koch, and D. C. Prince Sep. 1971 224 p refs
(Contract NAS3-11157)
(NASA-CR-72880; GE-R71AEG195) Avail: NTIS HC $13.25 CSCL 21E

A 0.5 hub/tip radius ratio compressor stage consisting of a 1500 ft/sec tip speed rotor, a variable camber inlet guide vane and a variable stagger stator was designed and tested with undistorted inlet flow, flow with tip radial distortion and flow with 90 deg, one-per-rev, circumferential distortion. At the design speed and design IGV and stator setting the design stage pressure ratio was achieved at a weight flow within 1% of the design flow. The rotor met its principal objective of achieving higher efficiencies at speeds above 1450 ft/sec than those achieved by a 1400 ft/sec design tip speed rotor tested under the same contract. Analytical results on rotor tip shock structure, deviation angle and part-span shroud losses at different operating conditions are presented. The variable geometry blading enabled efficient operation with adequate stall margin at the design condition and at 70% speed. Closing the inlet guide vanes of 40 deg changed the speed-versus-weight flow relationship along the stall line and thus provided the flexibility of operation at off-design conditions. A stage-matching analysis shows that the variable geometry IGV's can be used effectively to match a hypothetical second stage to the Task 2 Stage at off-design speeds with undistorted inlet flow. Author

N72-26694*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INTERNAL PERFORMANCE OF A 10 DEG CONICAL PLUG NOZZLE WITH A MULTISPOKE PRIMARY AND TRANSLATING EXTERNAL SHROUD

Donald L. Bresnahan Washington Jun. 1972 39 p refs
(NASA-TM-X-2573; E-6877) Avail: NTIS HC $3.00 CSCL 21E

An experimental investigation was conducted in a nozzle static test facility to determine the performance characteristics of a cold-flow, 21.59-centimeter-diameter plug nozzle with a multispoke primary. Two multispoke primary nozzles, a 12-spoke and a 24-spoke, were tested and compared with an annular plug nozzle. The supersonic cruise configurations for both spoke primaries performed about the same, with a gross thrust coefficient of 0.974, a decrease of approximately 1.5 percent from the reference nozzle. The takeoff configuration for the 12-spoke primary had a gross thrust coefficient of 0.957, a decrease of 1.5 percent from the reference nozzle, and the 24-spoke primary had a gross thrust coefficient of 0.95. Author

N72-26695*# General Electric Co., Cincinnati, Ohio. Aircraft Gas Turbine Div.

EXPERIMENTAL QUIET ENGINE PROGRAM AERODYNAMIC PERFORMANCE OF FAN A

R. G. Giffin, D. E. Parker, and L. W. Dunbar May 1971 112 p refs
(Contract NAS3-12430)
(NASA-CR-120858) Avail: NTIS HC $7.75 CSCL 21E

The aerodynamic component test results are presented of fan A, one of two high-bypass-ratio, 1160 feet per second single-stage fans, which was designed and tested as part of the NASA Experimental Quiet Engine Program. This fan was designed to deliver a bypass pressure ratio of 1.50 with an adiabatic efficiency of 86.5% at a total fan flow of 950 lb/sec. It was tested with and without inlet flow distortion. A bypass total-pressure ratio of 1.52 and an adiabatic efficiency of 88.3% at a total fan flow of 962 lb/sec were actually achieved. An operating margin of 12.4% was demonstrated at design speed. Author

N72-26696# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

RESEARCH ON CESIUM CONTACT MICROTHRUSTERS AT ONERA

Emile LeGrives and Jean Labbe 1972 10 p refs Presented at

9th AIAA Conf. on Elec. Propulsion, Washington, D. C., 17-19 Apr. 1972
(ONERA-TP-1060; AIAA-Paper-72-495) Avail: NTIS HC $3.00 CSCL 21C

The results obtained in the development of physical and analytical methods for testing cesium contact ion thrusters are reviewed. Neutral fraction measurements within the ion beam of a button type ionizer thruster model including computed optics were achieved by means of a cesium detector devised and calibrated in the laboratory. In accordance with overall intensity measurements, mostly slow neutrals are identified with a maximum total rate of 0.007. Probing of the ion current density also leads to good agreement with computed charge densities. Electrode sputtering forecast based on these results and prospects for thrust vector measurements are also presented. Author

N72-26697*# Rocketdyne, Canoga Park, Calif.
LIQUID ROCKET PERFORMANCE COMPUTER MODEL WITH DISTRIBUTED ENERGY RELEASE Final Report
L. P. Combs 10 Jun. 1972 130 p refs
(Contract NAS7-746)
(NASA-CR-114462; R-8888) Avail: NTIS HC $8.50 CSCL 21H

Development of a computer program for analyzing the effects of bipropellant spray combustion processes on liquid rocket performance is described and discussed. The distributed energy release (DER) computer program was designed to become part of the JANNAF liquid rocket performance evaluation methodology and to account for performance losses associated with the propellant combustion processes, e.g., incomplete spray gasification, imperfect mixing between sprays and their reacting vapors, residual mixture ratio striations in the flow, and two-phase flow effects. The DER computer program begins by initializing the combustion field at the injection end of a conventional liquid rocket engine, based on injector and chamber design detail, and on propellant and combustion gas properties. It analyzes bipropellant combustion, proceeding stepwise down the chamber from those initial conditions through the nozzle throat. Author

N72-26698*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECOVERY OF THRUST MAGNITUDE FROM MINITRACK DATA FOR THE SERT-2 SPACECRAFT
E. M. Jones Dec. 1970 23 p refs
(NASA-TM-X-65910; X-552-70-448) Avail: NTIS HC $3.25 CSCL 21H

An estimation of the thrust magnitude of the Space Electric Rocket Test (SERT) engine is obtained. This estimation is based on changes in the SERT-2 spacecraft orbit as determined from tracking data by using a revised definitive orbit determination system which includes the effect of thrust upon the motion of a spacecraft in general and the SERT-2 satellite in particular. The results of these computations are found to be in good agreement with values of acceleration as determined by an on-board accelerometer. A discussion of the mathematical model used to obtain the numerical results is also presented. Author

N72-26699# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
SAILING ON THE SOLAR WIND
Ulf Fahleson Feb. 1972 16 p
(TRITA-EPP-72-04) Avail: NTIS HC $3.00

Two possibilities are investigated for the extraction of energy from the solar wind's electric field for spacecraft propulsion. The first is based on the use of a long superconducting wire, in which current is generated by the solar wind's potential difference. Difficulties of thermal protection are discussed. It is estimated that a power of 1 MW can be delivered from a cable of about 1000 kg. The second is based on current conduction along a spacecraft-generated plasma beam, a tentative analysis of which is presented. Problems of current collection are discussed, and a global design of a spacecraft with these solar sails is mentioned. Author (ESRO)

N72-26700# Aerotherm Corp., Mountain View, Calif.
MATERIAL PERFORMANCE OF CARBON PHENOLIC ABLATORS AND PYROLYTIC GRAPHITE COATINGS IN NOZZLES SUBJECTED TO MULTIPLE PULSE DUTY CYCLES Final Report
Mitchell R. Wool and Duane L. Baker Oct. 1971 152 p refs
(Contract F04611-70-C-0019)
(AD-738622; Aerotherm-71-43; AFRPL-TR-71-130) Avail: NTIS CSCL 21/8

Measurements and analysis of the thermal and ablative response of five multiple pulse duty cycle rocket nozzles were performed. Nozzles were fired on a solid propellant simulator with a test stream composition, designated ANB-3066, which contained 16 percent aluminum. Nominal chamber pressure for each of the various firing pulses was 750 psia. Material temperature histories were recorded at several locations in each nozzle. Post-test measurements of surface recession, char penetration, and density versus depth, as well as themocouple data are used for comparison with one- and two-dimensional heat conduction and material ablation calculations. Author (GRA)

N72-26601*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ION SOURCES FOR ELECTRIC PROPULSION
Ernst Stuhlinger *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 47-60 refs (See N72-26593 17-25)
(NASA-TM-X-68383) Avail: NTIS HC $3.00 CSCL 21C

N72-26602*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAXIMUM PROPELLANT UTILIZATION IN AN ELECTRON BOMBARDMENT THRUSTER
Harold R. Kaufman and Allan J. Cohen *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 61-68 refs (See N72-26593 17-25)
(NASA-TM-X-68384) Avail: NTIS HC $3.00 CSCL 21C

N72-26605*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
KAUFMAN THRUSTER DEVELOPMENT AT LEWIS RESEARCH CENTER (LeRC)
William R. Kerslake and Paul D. Reader *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 85-92 refs (See N72-26593 17-25)
(NASA-TM-X-68385) Avail: NTIS HC $3.00 CSCL 21C

N72-26606*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SURVEY OF KAUFMAN THRUSTER CATHODES
Albert J. Weigand and Shigeo Nakanishi *In* BNL Proc. of the Symp. on Ion Sources and Formation of Ion Beams Oct. 1971 p 93-101 refs (See N72-26593 17-25)
(NASA-TM-X-68386) Avail: NTIS HC $3.00 CSCL 21C

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation, and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N72-26701 Maryland Univ., College Park.
MAGNETOGASDYNAMIC INTERACTIONS OF THE SOLAR WIND WITH PLANETARY BODIES Ph.D. Thesis
Stephen Frederick Sousk 1971 140 p
Avail: Univ. Microfilms Order No. 72-1693

New solutions of the frozen flow equations are developed in which the magnetic field is perpendicular to the velocity of the steady, inviscid flow. One solution illustrates enhancement of magnetic field near the stagnation point when there is frozen flow around a nonporous obstacle. A second solution illustrates magnetogasdynamic flow against an obstacle porous to the solar wind. The second case occurs at Mars and Venus. The analysis includes the region near the subsolar point in which the Alfven Mach number is less than unity. Close to the ionopause, the solar wind density is less than the density immediately downstream of the bow shock. The effect of the solar wind on hydrogen balance in the Venus atmosphere was estimated. For supersonic flow against a body highly porous to the solar wind such as the Moon, the point at which an attached shock touches the obstacle is computed. Relative motion between two electrically conducting species in the presence of a perpendicular component of magnetic field leads to currents which inhibit the interpenetration of the two species. The process can affect the solar wind at Mars, Venus, and the Moon, and can slow down the solar wind. Dissert. Abstr.

N72-26702# Lockheed Missiles and Space Co., Palo Alto, Calif.
METHOD OF CALCULATING THE ENERGY SPECTRUM CHARACTERISTICS OF ALBEDO ELECTRONS BY MEANS OF DATA FROM SHIELDED GAS-DISCHARGE COUNTERS
N. G. Skriabin and V. D. Sokolov 1972 6 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 12, no. 2, 1972 p 188-192
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method is proposed for determining the energy spectrum of albedo electrons by measuring the cosmic ray intensity using shielded and unshielded counters on board the cosmos 19. The albedo electron spectrum was determined in the cutoff hardness band. Author

N72-26046# Kiel Univ. (West Germany).
PRESENT KNOWLEDGE OF COSMIC RAYS
O. C. Allkofer *In* AGARD Spec. Biophys. Probl. in Aerospace Med., Pt. 3 Mar. 1972 14 p refs (See N72-26045 17-04)
Avail: NTIS HC $8.50

N72-26759*# Battelle-Northwest, Richland, Wash.
SOLAR AND GALACTIC COSMIC RAY EXPOSURE OF SURVEYOR 3 AS DETERMINED FROM COSMOGENIC RADIONUCLIDE MEASUREMENTS
L. A. Rancitelli, R. W. Perkins, N. A. Wogman, and W. D. Felix *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 196-200 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

N72-26760*# Bern Univ. (Switzerland).
SOLAR WIND RARE GAS ANALYSIS: TRAPPED SOLAR WIND HELIUM AND NEON IN SURVEYOR 3 MATERIAL
F. Buehler, P. Eberhardt, J. Geiss, and J. Schwarzmueller *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 201-208 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

N72-26761*# Washington Univ., St. Louis, Mo.
SOLAR PARTICLE TRACKS IN GLASS FROM SURVEYOR 3
G. Crozaz (Natl. Belge de la Rech. Sci., France) and R. M. Walker *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 209-212 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

N72-26762*# General Electric Co., Schenectady, N.Y.
VERY HEAVY SOLAR COSMIC RAYS: ENERGY SPECTRUM AND IMPLICATIONS FOR LUNAR EROSION
R. L. Fleischer, H. R. Hart, Jr., and G. M. Comstock *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 213-216 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

N72-26763*# California Univ., Berkeley.
ENHANCED EMISSION OF IRON NUCLEI IN SOLAR FLARES
P. B. Price, I. D. Hutcheon, R. Cowsik (TATA Inst. of Fundamental Res., Bombay), and D. J. Barber *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 217-220 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

N72-26764*# California Univ., Berkeley.
SOLAR FLARES, THE LUNAR SURFACE, AND GAS RICH METEORITES
D. J. Barber, R. Cowsik (TATA Inst. of Fundamental Res., Bombay), I. D. Hutcheon, P. B. Price, and R. S. Rajan *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 221-226 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N72-26703 Washington Univ., Seattle.
A SEARCH FOR INTERPLANETARY DUST Ph.D. Thesis
Donald Eugene Brownlee, II 1971 245 p
Avail: Univ. Microfilms Order No. 71-28384

Experiments conducted for collecting interplanetary particulate matter in the micron size range included four in the stratosphere using high altitude balloons, three in the mesosphere with sounding rockets, two in earth orbit using manned satellites, and one on the lunar surface as a result of the return of the Surveyor 3 TV camera by Apollo 12. The satellite and lunar experiments set reliable upper limits on the flux of micron-sized micrometeoroids. The lunar experiment established an upper limit to the flux of micrometeoroids larger than 2 x 10 to the minus 11th g of 0.000075 part./sq m/sec/(2 pi sterad). The impact rate of secondary micrometeoroids cn the lunar surface is roughly 1000 times the flux of extralunar particles. The balloon experiments allowed placing limits on the maximum amount of extraterrestrial particulates in the stratosphere; very few particles were collected but two are thought to be extraterrestrial. Techniques were also developed to enable fast, accurate location of small hypervelocity craters on surfaces exposed in space. Dissert. Abstr.

N72-26704 Polytechnic Inst. of Brooklyn, N.Y.
SPHERICAL ASYMMETRY IN THE WKB INVERSE SCATTERING PROBLEM OF PLANETARY OCCULTATION Ph.D. Thesis
Joseph A. Pirraglia 1971 220 p
Avail: Univ. Microfilms Order No. 71-29100

This document contains the results of studies of propagation in asymmetric media from the standpoint of the utilization of the measured characteristics of such propagation to deduce their structure by inversion. A particular application is the occultation experiment that has been successfully utilized in measurements of the atmospheres and ionospheres of Mars and Venus. The occultation experiment is a bistatic Doppler radar measurement. The residual Doppler shift, representing that portion of the total Doppler shift due to the medium about the planet, is derived from the total Doppler shift of a radio source as the source goes into and comes out of occultation by the planet. Assuming that the refractivity is small and the angular gradients are not large, it is shown that the derived profile can be expressed as an integral over the angular gradients. This is accomplished by an expansion of the medium in the angular coordinates. The expression shows that the profile obtained is approximately the profile of the actual medium, not along any vertical line, but along the locus of points generated by the point closest to the planet of each ray. Dissert. Abstr.

N72-26705 California Univ., San Diego.
A STUDY OF SIMULTANEOUS OPTICAL AND X-RAY OBSERVATIONS OF SCORPIUS X-1 Ph.D. Thesis
Ray Michael Pelling 1971 82 p
Avail: Univ. Microfilms Order No. 71-27900

The X-ray telescope carried on board the third orbiting solar observatory provided observations of the celestial X-ray source Sco X-1 in the energy range 7.7 to 22 keV during the period extending from 19 May to 13 June 1967. Instrument response and sensitivity between these dates allowed measurement of the source flux in the 7.7 to 12.5 keV energy channel at a 10 to 20 percent confidence level for each of about ten two-minute integration periods available during a typical 90-minute orbital period. Simultaneous optical observations available during portions of X-ray coverage allowed determination of correlation properties of the X-ray and optical emissions for both the flaring and quiescent optical states. Dissert. Abstr.

N72-26706 Georgetown Univ., Washington, D.C.
ACCURATE POSITIONS AND PROPER MOTIONS OF STARS IN THE REGION OF THE HYADES CLUSTER OBTAINED BY THE PLATE OVERLAP METHOD Ph.D. Thesis
Erich H. Rutscheidt 1971 347 p
Avail: Univ. Microfilms Order No. 71-30341

Accurate positions and proper motions were derived for the area of the Hyades Cluster, using the plate overlap method. The mean epoch of the earlier photography was 1904.66 and the mean epoch of the later photography was 1968.40, thus giving an unusually large interval of 63.74 years. The area covered by the first epoch plates was 9 deg x 9 deg or 81 square degrees, with limits from +11 deg to +20 deg in declination and 4h 06m to 4h 43m in right ascension. The 32 first epoch plates, were observed at the Paris and Bordeaux observatories, with corner to center overlap as part of the Astrographic catalogue. The limiting magnitude of the stars on the plates was 12m6. These plates were recomputed with 296 positions and proper motions of stars based on the FK4 system, for the epoch and equinox 1950.0, taken from the Smithsonian Astrophysical Observatory Star Catalog (SAOC). The area covered by the second epoch photography was centered on BD +15 deg 637 covering an area of 6 deg x 6 deg or approximately 36 square degrees, with limits from +13 deg to +19-1/2 deg in declination and from 4h 13m to 4h 40m in right ascension. Dissert. Abstr.

N72-26707 Yale Univ., New Haven, Conn.
THE MOTIONS OF THE SATELLITES OF URANUS Ph.D. Thesis
David Waring Dunham 1971 165 p
Avail: Univ. Microfilms Order No. 71-28160

An 18-year series of photographs of the satellites of Uranus was used in the investigation. Ephemeris time and an improved theory of the motions of the satellites are used in the computation of the residuals. The method of analysis uses the observed right ascensions and declinations of the satellites rather than measurements of the satellites with respect to each other. Nightly corrections to the position of Uranus were determined from these solutions, as well as more reliable values for the orbital elements of the satellites. Dissert. Abstr.

N72-26708 Yale Univ., New Haven, Conn.
POSITIONS OF GLOBULAR CLUSTER STARS IN THE PHYSICAL H-R DIAGRAM Ph.D. Thesis
Wayne Henry Osborn 1971 224 p
Avail: Univ. Microfilms Order No. 71-29714

An intermediate band photometric system was used to observe late-type globular cluster stars for the purpose of obtaining physical data suitable for comparison with the predictions of theoretical Population 2 evolutionary calculations. The system was calibrated such that the DDO colors of any star may be used to determine its (Fe/H), its effective temperature, and its surface gravity. These quantities were derived from observations of several red giant branch, horizontal branch, and asymptotic branch members in each of the clusters M3, M5, M10, M13, and M92. By adopting distance moduli for the clusters, absolute magnitudes and estimates of the masses of the observed stars were also obtained. Dissert. Abstr.

N72-26709 California Inst. of Tech., Pasadena.
MARTIAN SPECTRAL REFLECTIVITY PROPERTIES FROM MARINER 7 OBSERVATIONS Ph.D. Thesis
James Alfred John Cutts 1971 102 p
Avail: Univ. Microfilms Order No. 72-470

An analysis of data taken by the Mariner 6 and Mariner 7 spacecraft was made in order to extend the knowledge of spectral reflectivity differences on the surface of Mars. The data were collected with the Mariner aide-angle television camera which utilizes a vidicon image tube as sensor. The data consist of a series of pictures taken through sequenced color filters with passbands in the visible region of the electromagnetic spectrum. Color differences attributable to geographic variations in the reflecting properties of the surface and/or atmosphere are recognized in an area near the center of the Martian disk. The reflectivity ratio red/green for these areas is strongly correlated with the normal albedo but varies inversely as the reflectivity ratio blue/green. Near the center of the Martian disc, three distinct reflectivity groups are recognized indicating the existence of abrupt transitions in reflectivity and extensive homogeneous areas with little variation in intrinsic reflectivity. Dissert. Abstr.

N72-26710 Case Western Reserve Univ., Cleveland, Ohio.
HIGH TEMPERATURE HEATING BY STELLAR WINDS Ph.D. Thesis
Thomas John Wdowiak 1971 79 p
Avail: Univ. Microfilms Order No. 72-122

The dissipation by a shock of the kinetic energy in a high-velocity stellar wind is investigated as a mechanism for producing X-rays. The equations of mass, momentum, and energy are used to calculate the post-shock structure of an optically thin plasma cooled by thermal bremsstrahlung. Stellar wind velocity, mass motion rates, and electron densities of celestial X-ray sources are used to establish initial parameters in the post-shock flow problem. The temperature and density structure of the post-shock nonadiabatic flow establishes the X-ray spectrum in the 1 to 100 keV energy range. This spectrum closely mimics the thermal bremsstrahlung spectrum of an isothermal plasma having an electron temperature of approximately 2/3 that of the relaxed plasma immediately after the shock in the quasi-adiabatic post-shock region. This result implies that the X-ray spectra of such objects as Sco XR-1 could be interpreted as due to shock phenomena. The apparent absorption observed for sources in the 1 keV range may be due to cooled post-shock matter. Dissert. Abstr.

N72-26711 Northwestern Univ., Evanston, Ill.
AN INVESTIGATION OF THE KINEMATICS OF THE IONIZED GAS IN THE PECULIAR GALAXY M82 Ph.D. Thesis
Harry Mervin Heckathorn, III 1971 202 p
Avail: Univ. Microfilms Order No. 71-30828

Twenty spectra were obtained of the emission halo with a 40-inch telescope. Slit orientations were parallel to the apparent major axis of the galaxy with the slit crossing the minor axis at distances as large as 45 arc seconds from the apparent nucleus of the galaxy. The spectra record H alpha, (N II)6548,6583 and (S II)6717,6731 in emission. These spectra all have the emission lines significantly tilted, indicative of a rotational velocity field in the emission halo extending considerably above and below the fundamental plane of the galaxy. A technique was developed to remove the effects of distortion due to the use of the image intensifiers. A contour map of the velocity field as defined by the emission lines was constructed from the measured velocity curves. The conclusion is that the bulk of ionized gas in M82 is probably both expanding along and rotating about an axis coincident with the axis of rotation of the stellar population of the galaxy. Dissert. Abstr.

N72-26712 Maryland Univ., College Park.
MULTI-COLOR PHOTOMETRY OF SUPERGIANTS AND CEPHEIDS Ph.D. Thesis
Thomas Kelsall 1971 238 p
Avail: Univ Microfilms Order No. 72-1641

The results of photometry of supergiants and Cepheids in a seven filter system are presented. A color index is used in combination with other colors to produce four indices freed from the effects of interstellar reddening. These four indices give measures of the Balmer discontinuity, effects of the metallic line absorption in the violet region of the spectra, break in the spectrum across the G-band, and the strength of the cyanogen band head at 4216A. The separation of supergiants from stars of other luminosity classes is possible. The values of various color-color loop areas can be used to distinguish Cepheids of Pop. I and Pop. II. This procedure is independent of interstellar reddening. The Balmer discontinuity index for supergiants and Cepheids is insensitive to the effects of line blanketing. The strengths of the metallic line absorption and CN absorption are strongly correlated. Dissert. Abstr.

N72-26713 Maryland Univ., College Park.
LUNAR OCCULTATIONS OF THE GALACTIC CENTER REGION IN HI, OH AND CH2O LINES Ph.D. Thesis
Aage Sandqvist 1971 214 p
Avail: Univ. Microfilms Order No. 72-1647

In the period from January 1968 to March 1970, ten lunar occultations of the galactic center region were observed with a 140-foot radio telescope, using a 100-channel autocorrelator for the first two occultations, and a 413-channel autocorrelator for the remaining eight. Seven events were observed in the 1667-MHz OH line, five in the 1665-MHz OH line, one in the 1720-MHz OH line, six in the 1420-MHz HI line and, two in the 4830-MHz CH2O line. During five occultations, the 1665- and 1667-MHz OH lines and the 1420-MHz HI line were observed simultaneously. Continuum occultation curves at the above frequencies, were obtained. The continuum radio source, Sgr A, was occulted seven times, the weaker source, G359.4-0.1, once. Baseline-corrected antenna temperature contour maps on grid of velocity versus sidereal time were produced for all the observed lines. Opacity contour maps were also produced, as well as differentiated contour maps of selected parts of the occultations. Dissert. Abstr.

N72-26714*# Oregon State Univ., Corvallis. Dept. of Chemistry.
BULK, RARE EARTH AND OTHER TRACE ELEMENTS IN APOLLO 14 AND 15 AND LUNA 16 SAMPLES
J. C. Laul, H. Wakita, D. L. Showalter, W. V. Boynton, and R. A. Schmitt [1971] 38 p refs
(Grants NGL-38-002-039; NGL-38-002-020)
(NASA-CR-127075) Avail: NTIS HC $4.00 CSCL 03B

The chemical abundances were measured by instrumental and radiochemical neutron activation analysis in a variety of lunar specimens. Apollo 14 soils are characterized by significant enrichments of Al2O3, Na2O and K2O and depletions of TiO2, FeO, MnO and Cr2O3 relative to Apollo 11 and to most of Apollo 12 soils. The uniform abundances in 14230 core tube soils and three other Apollo 14 soils indicate that the regolith is uniform to at least 22 cm depth and within approximately 200 m from the lunar module. Two Luna 16 breccias are similar in composition to Luna 16 soils. Four Apollo 15 soils (LM, STA 4, 9, and 9a) have variable compositions. Interelement correlations between MnO-FeO, Sc-FeO, V-Cr2O3 and K2O-Hf negate the hypothesis that howardite achondrites may be primitive lunar matter, argue against the fission hypothesis for the origin of the moon, and precludes any selective large scale volatilization of alkalies during lunar magmatic events. Author

N72-26715*# Wisconsin Univ., Madison. Dept. of Physics.
ON THE He(PLUS) TRIPLET LINE INTENSITIES
E. Daltabuit and D. Cox [1971] 9 p refs
(Grant NGL-50-002-044)
(NASA-CR-127064) Avail: NTIS HC $3.00 CSCL 03A

The theoretical calculations of helium triplet line strengths, including collisional enhancement, are compared to astronomical observations. Both are plotted on an I(10830)/I(5876) vs I(5876)/I(4471) plane. It appears that the theory of helium triplet line strengths agrees with present observations, and that the question of an additional depopulation mechanism for the 2 3S population is probably predicted correctly within 30%. Author

N72-26716*# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
CONJUGATE GRADIENT OPTIMIZATION PROGRAMS FOR SHUTTLE REENTRY Final Report
W. F. Powers, R. A. Jacobson, and D. A. Leonard May 1972 100 p refs
(Contract NAS8-26929)
(NASA-CR-123720; Rept-010021-F) Avail: NTIS HC $7.00 CSCL 22A

Two computer programs for shuttle reentry trajectory optimization are listed and described. Both programs use the conjugate gradient method as the optimization procedure. The Phase 1 Program is developed in cartesian coordinates for a rotating spherical earth, and crossrange, downrange, maximum deceleration, total heating, and terminal speed, altitude, and flight path angle are included in the performance index. The programs make extensive use of subroutines so that they may be easily adapted to other atmospheric trajectory optimization problems. Author

N72-26717*# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
EXPLORATORY DEVELOPMENT AND SERVICES FOR PREPARING AND EXAMINING ULTRATHIN POLISHED SECTIONS OF LUNAR ROCKS AND PARTICULATES, PART 1 Final Report, 23 Jun. 1971 - 23 Mar. 1972
R. H. Beauchamp, J. F. Williford, and E. L. Gafford 23 Mar. 1972 28 p Revised
(Contract NAS9-11993)
(NASA-CR-115555; Rept-211B00862-Pt-1-Rev-1) Avail: NTIS HC $3.50 CSCL 03B

Development of improved procedures is reported for three classes of lunar materials: dense rocks, breccias, and particulates. High quality ultrathin sections of these materials are obtained. Lists of equipment and supplies, procedures, photomicrographic documentation, and training are provided. Advantages of ultrathin polished sections for conventional and unconventional optical microscopy methods are described. Recommendations are provided for use of ultrathin sections in lunar rock studies, for further refinement of ultrathinning procedures, and for additional training efforts to establish a capability at the Manned Space Center. For Part 2, See N72-50754. Author

N72-26718*# Israel Program for Scientific Translations, Ltd., Jerusalem.
EVOLUTION OF THE PROTOPLANETARY CLOUD AND FORMATION OF THE EARTH AND THE PLANETS
V. S. Safronov 1972 211 p refs Transl. into ENGLISH of the book "Evolyutsiya doplanetnogo Oblaka i Obrazovanie Zemli i

Planet" Moscow, Izdatelstvo Nauka, 1969 Sponsored by NASA and NSF
(NASA-TT-F-677; TT-71-50049) Avail: NTIS HC $3.00 CSCL 03B

The physicomechanical aspects of the emergence of the planets are discussed, based on the concept of accretion from solid bodies and particles which, together with the gases, made up the protoplanetary cloud enveloping the sun in the early phases of its development. The idea of accretion was extensively developed in Shmidt's theory and later in the physicochemical studies of meteorites carried out by Urey and others. The evolution of the gas-dust protoplanetary cloud and the formation of a cluster of solid bodies is studied first. Then the fundamental laws of dynamics in a rotating system of gravitating bodies with inelastic collisions and the process of accumulation of planets by the aggregation of solid bodies and particles are investigated. Finally, a method is developed for evaluating the primary temperature of the earth, and the question of primary inhomogeneities in the earth mantle is discussed. Author

N72-26719*# Techtran Corp., Glen Burnie, Md.
METEORIC PROPAGATION OF RADIO WAVES, NO. 7
V. V. Sidorov, ed. and G. M. Teptin, ed. Washington May 1972 141 p refs Transl. into ENGLISH from the book "Meteoronoye Rasprostraneniye Radiovoln, no. 7" Kazan, Kazan Univ. Press, 1970 p 1-125
(Contract NASw-2037)
(NASA-TT-F-705) Avail: NTIS HC $3.00 CSCL 03B

The results of studies of meteoric phenomena embracing a wide range of problems of meteor astronomy, the use of meteors in geophysical investigations and for transmission of information and accurate time signals are presented. For individual titles, see N72-26720 through N72-26729.

N72-26720*# Techtran Corp., Glen Burnie, Md.
THE DISTRIBUTION OF THE GEOCENTRIC VELOCITIES OF SPORADIC METEORS OVER THE CELESTIAL SPHERE
N. S. Andrianov and Yu. A. Pupyshev *In its* Meteoric Propagation of Radio Waves May 1972 p 1-18 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 03B

The distribution of the geocentric velocities of sporadic meteors determined photographically and by radar was studied. No seasonal dependence was found, but radio meteors showed a tendency to concentrate towards the parabolic limits. Transformation from the photographic meteor distribution to the radio meteor distribution was accomplished by means of derived conversion coefficients. Larger meteor fluxes result from the photographic meteor distribution than from the transformed photographic distribution. Use of a model with a constant heliocentric meteor velocity of 36 km/sec leads to a lower meteor flux than does use of the transformed photographic meteor distribution. An error as large as a factor of 1.5 - 2 results if the constant-velocity model is used instead of the observed velocity distribution. Author

N72-26721*# Techtran Corp., Glen Burnie, Md.
SOLUTIONS OF A HIGH ORDER SYSTEM OF ALGEBRAIC EQUATIONS OF CONDITION IN WHICH THE COEFFICIENTS, FREE TERMS, AND UNKNOWNS ARE POSITIVE NUMBERS c19
Yu. A. Pupyshev and L. D. Shevchenko *In its* Meteoric Propagation of Radio Waves May 1972 p 19-32 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 12A

The problem of solving equations of conditions in which the coefficients, constants, and free terms are all positive is considered. Application of Gauss' method leads to an incorrect solution for the meteor flux distribution as a function of ecliptic longitude. Indirect methods of solution based on the fact that the coefficients, constants, and free terms in the equations of condition are all positive are developed. These methods involve successive approximation, and it is shown that the solution is not sensitive to the number of unknowns involved in the solution. Good fits to Hawkins' triple-humped distribution and a single-humped distribution are obtained. Good agreement between the observed and calculated daily variations in the average hourly number of meteors was obtained after 32 iterations. Author

N72-26722*# Techtran Corp., Glen Burnie, Md.
PROBABILITY OF IONIZATION IN METEOR TRAILS
V. S. Tokhtasyev *In its* Meteoric Propagation of Radio Waves May 1972 p 33-54 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 03B

The ionization probability in meteor trails is calculated and its velocity dependence is determined over the range of meteor velocities. The probabilities are calculated by the semi-empirical method, which is based on theoretical and experimental data for the effective ionization and diffusion cross sections of the principal meteor atoms. Experimentally determined interaction potentials are used to calculate the diffusion cross sections. A velocity dependence for the ionization probability is found which agrees with Oepik's results for stony meteorites within a factor of 2 over the range of meteor velocities. Author

N72-26723*# Techtran Corp., Glen Burnie, Md.
ADDITIONAL IONIZATION MECHANISMS IN METEOR TRAILS
V. S. Tokhtasyev *In its* Meteoric Propagation of Radio Waves May 1972 p 55-72 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 03B

The possibility of the existence of additional sources of ionization in meteor trails besides Herlofson's mechanism is investigated. Such a source is necessary to explain the large diffusion coefficients in the 80-90 km altitude range and the large values of the maximum polarization ratio. In Tokhtasyev's opinion the most suitable source of additional ionization in meteor trails is thermoelectric emission from the surfaces of meteor particles. Author

N72-26724*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE DIRECTIONALITY OF METEORIC PROPAGATION OF RADIO WAVES c07
R. A. Kurganov *In its* Meteoric Propagation of Radio Waves May 1972 p 73-94 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 20N

Factors which influence the directionality of meteoric propagation of radio waves are analyzed. The first part of the paper is concerned with the experimental determination of the parameters of importance, while the second part involves a theoretical calculation of these parameters and a comparison of them with the experimentally determined values. On the basis of experimental and computational investigations, it is concluded that the only directionality parameter which has in practice a significant diurnal variation is the optimal azimuth. The diurnal variation of the optimal azimuth and elevation angles does not exceed 2 deg for either the number or coverage coefficient density distributions considered. Also, the variations in the directionality parameters as a function of the transmitter's wavelength do not exceed 2 deg. Author

N72-26725*# Techtran Corp., Glen Burnie, Md.
NECESSITY FOR TAKING INTO ACCOUNT THE DISTRIBUTION OF THE VELOCITY AND DENSITY OF THE INCIDENT FLUX OF METEOR PARTICLES IN PREDICTING METEORIC PROPAGATION OF RADIO WAVES
R. A. Kurganov and T. V. Kazakova *In its* Meteoric Propagation of Radio Waves May 1972 p 95-104 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 03B

The distribution of meteor velocities and the nonuniformity in the incident flux density distribution of meteor particles must be taken in account in predicting the principal parameters of meteoric radio wave propagation. Comparison with experimental results indicates that an accuracy of 30 percent can be achieved. Author

N72-26726*# Techtran Corp., Glen Burnie, Md.
A METHOD OF DETERMINING WIND CHARACTERISTICS IN THE METEOR ZONE BY THE RADAR METHOD c07
G. B. Pokrovskiy *In its* Meteoric Propagation of Radio Waves May 1972 p 105-117 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 17I

Five different methods are investigated for determining the wind profiles in the atmosphere's meteor zone from radar observations carried out in two mutually perpendicular directions or by continuous azimuthal scanning. Comparison of the results shows that the method of least squares is the most satisfactory one for carrying out the numerical reduction. The other methods give poor results and can be recommended only in the absence of access to an electronic computer. Author

N72-26727*# Techtran Corp., Glen Burnie, Md.
CALCULATION OF THE EFFECT OF THE RADIATION PATTERN ANTENNAS IN DETERMINING THE PARAMETERS OF ATMOSPHERIC MOTIONS c07
G. M. Teptin *In its* Meteoric Propagation of Radio Waves May 1972 p 118-125 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 20N

The effect of antenna directional diagrams on the determination of the parameters of anisotropic atmospheric turbulence is studied. Derived corrections to the average wind velocity are practically the same as for isotropic turbulence. The dependence of the average wind velocity corrections on the wind direction is strengthened somewhat over the isotropic case. Distortions of the values of the turbulent velocity distribution parameters are the same in the nonisotropic case as for the isotropic case. The calculations were carried out for 3-, 5-, and 7-element antennas on the assumption of a uniform distribution of meteor radiants. Author

N72-26728*# Techtran Corp., Glen Burnie, Md.
THE PROBLEM OF DETERMINING THE TEMPORAL POSITION OF PULSES REFLECTED FROM METEOR TRAILS
V. V. Sidorov and A. N. Pleukhov *In its* Meteoric Propagation of Radio Waves May 1972 p 126-133 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 03B

The accuracy of the arrival times of pulses with amplitudes much greater than the threshold level is determined. This problem is of importance in the design of synchronization methods for the input distributors of meteoric radio propagation systems. The results of calculations show that better accuracy is obtained in measuring the arrival time delays of pulses reflected from meteor trails when the measuring level and the threshold response level are not matched and when comparatively narrow transmission bandwidths are used. Author

N72-26729*# Techtran Corp., Glen Burnie, Md.
DETERMINATION OF THE SEMI-DIURNAL PRESSURE VARIATIONS IN THE UPPER ATMOSPHERE c13
G. M. Teptin *In its* Meteoric Propagation of Radio Waves May 1972 p 134-138 refs (See N72-26719 17-30)
Avail: NTIS HC $3.00 CSCL 04A

The semi-diurnal pressure variations in the upper atmosphere are calculated using the equations of hydrodynamics and the results of radiometeor observations. The results reveal a noticeable seasonal variation in the pressure variations of the upper atmosphere. Also calculated are semi-diurnal density variations and satisfactory agreement is found between the observed and calculated amplitude and phase. The amplitude of the density variations decreases when the temperature variations are taken into account, but the phase remains unchanged. Author

N72-26730*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LUNAR EPHEMERIS SELENOGRAPHIC COORDINATES OF THE EARTH AND SUN FOR 1975 AND 1976
Ann D. Hartung Washington 1972 441 p refs
(NASA-SP-3059) Avail: NTIS HC $6.00 CSCL 03B

Ephemeris data are presented for 1975 and 1976 to provide a time history of lunar coordinates and related geometric information. A Manned Spacecraft Center modification of the Jet Propulsion Laboratory ephemeris tape was used to calculate and plot coordinates of the earth, moon, and sun. The ephemeris is referenced to the mean vernal equinox at the nearest beginning of a Besselian year. Therefore the reference equinox changes from one year to the next between 30 June and 1 July. The apparent discontinuity in the data is not noticeable in the graphical presentation, but can be observed in the digital output. The mean equator of epoch is used in all cases. Author

N72-26731*# National Aeronautics and Space Administration, Washington, D.C.
ANALYSIS OF SURVEYOR 3 MATERIAL AND PHOTOGRAPHS RETURNED BY APOLLO 12
1972 302 p refs Original contains color illustrations
(NASA-SP-284; LC-70-181874) Avail: NTIS; SOD $4.00 CSCL 03B

Postflight analysis of Surveyor 3 material included results of engineering tests done on the spacecraft hardware, changes occurring in spacecraft surfaces and components, organic contamination and micrometeorite impact analyses, radioactivity and radiation damage analyses, solar wind-rare gas analysis, soil property and microbe survival analyses, and spacecraft orientation and exposure to the lunar environment. For individual titles, see N72-26732 through N72-26772.

N72-26732*# National Aeronautics and Space Administration, Washington, D.C.
INTRODUCTION
W. F. Carroll (JPL), R. Davis (JPL), M. Goldfine (JPL), S. Jacobs, L. D. Jaffe (JPL), L. Leger, B. Milwitzky, and N. L. Nickle (JPL) *In its* Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 1-8 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

The rationale and objectives for landing an Apollo mission near a Surveyor spacecraft on the moon are discussed. Surveyor 3 and the planning of the Apollo 12 flight are considered. Mission operations and returned material, including material handling, are reviewed. The analysis of the returned parts, soil, and photographs is considered. K.P.D.

N72-26733*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUMMARY AND CONCLUSIONS
N. L. Nickle and W. F. Carroll *In* NASA, Wasnington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 9-13 (See N72-26731 17-30)
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A summary is presented of the engineering and scientific results derived from the investigations conducted on the returned Surveyor 3 hardware, lunar soil, and photographs taken by the Apollo 12 astronauts. Author

N72-26734*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
RETURNED SURVEYOR 3 HARDWARE: ENGINEERING RESULTS
W. F. Carroll (JPL), P. M. Blair, Jr. (Hughes Aircraft Co., Culver City, Calif.), E. I. Hawthorne (Hughes Aircraft Co., Culver City, Calif.), S. Jacobs, and L. Leger *In its* Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 15-21 refs (See N72-26731 17-30)
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A summary is presented of an engineering evaluation of returned hardware. No failures or serious adverse environment effects on the hardware were uncovered that were not anticipated. The absence of detected major effects and the resulting implications for future space vehicles are significant. Electronic components, including the vidicon tube, optics, materials, mechanisms, and lubricants, were in generally good condition. No identified failures or anomalies, with the exception of those resulting from thermal cycling, were caused primarily by the lunar environment. The darkened color of originally white surfaces, as observed by the astronauts, was due to expected radiation damage and to the coating of lunar dust. All anomalies associated with lunar operations of the Surveyor 3 television camera were resolved. Author

N72-26735*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

LUNAR DUST AND RADIATION DARKENING OF SURVEYOR 3 SURFACES

W. F. Carroll and P. M. Blair, Jr. (Hughes Aircraft Co., Culver City, Calif.) *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 23-28 refs (See N72-26731 17-30)
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Measured spectral reflectance, evidence obtained from photographs, scanning electron microscopy, and previous work on Surveyor hardware were used to develop an understanding of the observed discoloration and its meaning to future space and lunar operations. Measured reflectance data were analyzed to separate and understand the effects of lunar dust and radiation damage. It was concluded that organic contamination is not a major contributor to the discoloration. Radiation-induced discoloration on the various surfaces was found to be proportional to the degree of solar illumination. Photobleaching of the radiation damage was observed and was responsible for a gradual change in the color of the camera's surface during the evaluation. Author

N72-26736*# Battelle-Northwest, Richland, Wash.

CHARACTERIZATION OF DUST ON CLEAR FILTER FROM RETURNED SURVEYOR 3 TELEVISION CAMERA

D. M. Robertson, E. L. Gafford, H. Tenny, and R. S. Strebin, Jr. *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 29-46 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

Surveyor 3 landed on the moon in April 1967. Part of the spacecraft was returned to earth in November 1969 by the Apollo 12 astronauts. A stripping film containing dust removed from the camera light filter was received for study. The study involved the characterization of the dust; the results of the study are presented. Author

N72-26737*# Geological Survey, Menlo Park, Calif.

DEBRIS ON THE SURVEYOR 3 MIRROR

M. H. Carr and S. J. Proudfoot *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 47-50 ref (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 20F

Work is described which was performed on debris that adhered to the Surveyor 3 camera mirror after it was returned from the moon by the Apollo 12 mission. The chemical and morphological natures of the debris are described and some fine scale features of the mirror surface are discussed. Supplementary information was provided on the adhering debris so that the causes of the optical degradation of the mirror could be determined more accurately. Author

N72-26738*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

DYNAMIC CONSIDERATIONS OF DUST ON THE TELEVISION CAMERA MIRROR

N. L. Nickle *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 51-59 refs Original contains color illustrations (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 20F

The mirror on the Surveyor 3 television camera was subjected to tests which modified its surface. Lunar dust was removed by rubbing, by acetate and metallic film stripping techniques, rinsing, scraping, and by inadvertently touching the surface. A second shadow line was revealed. Second and third generation peels were taken across the upper shadow line, and a study was made in order to define the source(s) or events(s) responsible for creating the two shadow lines occurring on the lower part of the mirror. K.P.D.

N72-26739*# Geological Survey, Flagstaff, Ariz.

CHANGES IN OPTICAL PROPERTIES OF THE SURVEYOR 3 CAMERA

J. Rennilson (California Inst. of Tech., Pasadena), H. Holt, and K. Moll *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 60-76 refs Original contains color illustrations (See N72-26731 17-30)
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The measurements made to analyze changes in the camera's optical performance involved the following areas: (1) spectral reflectance (specular), (2) gonioreflectance, (3) ellipsometry, (4) spectral transmission, (5) contrast and modulation transfer, and (6) photography (macro and micro). Author

N72-26740*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PARTICLE IMPACT AND OPTICAL PROPERTY ANALYSIS OF THE SURFACES OF SURVEYOR 3 MATERIALS

D. L. Anderson, B. E. Cunningham, R. G. Dahms, and R. G. Morgan *In its* Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 76-88 refs (See N72-26731 17-30)
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As part of the investigation of Surveyor 3 materials, a study was conducted to determine the effect of the lunar environment on some of the painted and unpainted exterior surfaces. Examination of the camera parts and tube sections was conducted using three techniques: (1) optical and scanning electron microscopy, (2) energy dispersive X-ray probe analysis, and (3) spectral reflectance measurements. Author

N72-26741*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

EXAMINATION OF SURVEYOR 3 PARTS WITH THE SCANNING ELECTRON MICROSCOPE AND ELECTRON MICROPROBE

A. A. Chodos (California Inst. of Tech., Pasadena), J. R. Devaney, and K. C. Evens *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 89-90 (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

Two screws and two washers, several small chips of tubing, and a fiber removed from a third screw were examined with the scanning electron microscope and the electron microprobe. The purpose of the examination was to determine the nature of the material on the surface of these samples and to search for the presence of meteoritic material. Author

N72-26742*# GCA Corp., Bedford, Mass.

SPUTTER-ION SOURCE MASS SPECTROMETER ANALYSIS OF SAMPLES CUT FROM THE SURVEYOR 3 CAMERA

F. G. Satkiewicz and F. F. Marmo *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 91-94 (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 20F

Four samples were studied as part of the evaluation of the component parts of the material recovered from the Surveyor 3 spacecraft. Before analyzing the samples, a calibration sample was obtained. The distribution of lunar fines on painted and polished surfaces is presented. K.P.D.

N72-26743*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BLOWING OF LUNAR SOIL BY APOLLO 12: SURVEYOR 3 EVIDENCE
L. D. Jaffe *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 94-96 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

It is shown that the discoloration pattern of the Surveyor 3 camera provides evidence that the camera surface was whitened by the impact of particles blown from the lunar surface by the exhaust of the lunar module as it landed. It also indicates the velocity and direction at which these particles were ejected. Author

N72-26744*# Boeing Co., Seattle, Wash.
LOW-TEMPERATURE OXYGEN-PLASMA EFFECTS ON SURVEYOR PLASMO-CLAY COATING
R. B. Gillette *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 96-100 (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

The objective was to determine whether the reflectance of the degraded plasmo-clay thermal control coating could be restored by exposing it to an oxygen plasma. An experiment was conducted to determine whether bulk radiation damage would be removed by a reabsorption of oxygen ions into the pigment crystal lattice. Results show that the oxygen plasma treatment can eliminate some of the lunar environment-induced degradation on the plasmo-clay coating. Visual observations of the lunar soil on the surface after plasma treatment indicated that it was still highly absorbent to light. Therefore, part of the residual discoloration could be due to lunar soil. K.P.D.

N72-26745*# California Inst. of Tech., Pasadena.
EXAMINATION OF THE SURVEYOR 3 SURFACE SAMPLER SCOOP c14
R. F. Scott and K. A. Zuckerman *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 100-114 refs Original contains color illustrations (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 14B

The operation and external appearance of the surface sampling scoop are discussed. An attempt was made to measure the magnitude of the existing adhesion between the lunar soil and the various surfaces of the scoop. K.P.D.

N72-26746*# California Inst. of Tech., Pasadena.
MOVEMENT OF THE SURVEYOR 3 SPACECRAFT
R. F. Scott, T.-D. Lu, and K. A. Zuckerman *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 114-119 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

It was concluded that the Surveyor 3 spacecraft moved, probably as a result of a sudden failure of the leg 3 shock absorber, between May 1967 and November 1969. The time at which the movement occurred can be estimated only from comparison of the shielded and unshielded portions of footpad 3 and a knowledge of the mechanism and rate of the process that tans the painted surface. K.P.D.

N72-26747*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF SURVEYOR 3 TELEVISION CABLE c09
F.C. Gross and J. J. Park *In its* Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 119-125 (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 09A

A sample of cable described as four inches of TV cable, fabric wrapped, which had been exposed to the atmosphere for an unknown period of time, was subjected to extensive chemical analyses for the various components. The fabric was tested using attenuated total reflectance, chloroform extract, aqueous extraction, pyrolysis infrared, and reflectance spectroscopy. The wire insulation was tested using pyrolysis infrared, pyrolysis gas chromatography, differential thermal analysis, attenuated total reflectance subsurface, and tensile tests. Corrosion was also observed in parts of certain wires. K.P.D.

N72-26748*# California Univ., Berkeley.
ORGANIC CONTAMINATION ANALYSIS: HIGH RESOLUTION MASS SPECTROMETRIC ANALYSIS OF SURFACE ORGANICS ON SELECTED AREAS OF SURVEYOR 3
B. R. Simoneit and A. L. Burlingame *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 127-142 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

The mirror and middle shroud were extracted for organics by washing the surfaces with solvents. The techniques are discussed. Ion microprobe analyses of the primarily atomic species are presented. The sources of the organic contaminants are: (1) hydrocarbons from lubricating oils and general terrestrial contamination, (2) dioctyl phthalate, probably from polyethylene bagging material (the plasticizer), (3) carboxylic acids from decomposition of grease and general terrestrial contamination, (4) silicones from sources such as lubricating oil, (5) outgassing of electronics and plasticizer, (6) vinyl alcohol and styrene copolymer, probably from electronic insulation, and (7) nitrogenous compounds from the lunar module and possibly Surveyor 3 engine exhaust. K.P.D.

N72-26749*# Washington Univ., Seattle.
PRIMARY AND SECONDARY MICROMETEOROID IMPACT RATE ON THE LUNAR SURFACE: A DIRECT MEASUREMENT
D. E. Brownlee, II, W. Bucher, and P. Hodge *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 143-151 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

Determination of the number of micrometeoroid impact craters on the camera provided an opportunity to make a sensitive direct measurement of the flux of interplanetary dust particles impacting the lunar surface. Optical and scanning electron microscope studies were performed. Low velocity impact and flux analyses are presented. Author

N72-26750*# Dudley Observatory, Albany, N.Y.
PRELIMINARY EXAMINATION OF SURVEYOR 3 COMPONENTS FOR IMPACT PHENOMENA
D. S. Hallgren, A. T. Laudate, R. P. Schwarz, W. D. Radigan, and C. L. Hemenway *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 151-153 (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 14B

Two pieces of the Surveyor 3 spacecraft recovered during the Apollo 12 mission were examined for secondary lunar ejecta and micrometeorite impacts. One piece was section E of the aluminum strut; the other was the nickel-coated beryllium television camera mirror. Author

N72-26751*# Shock Hydrodynamics, Inc., Sherman Oaks, Calif.
EXAMINATION OF SAMPLE OF SURVEYOR 3 STRUT FOR METEOROID IMPACTS
L. Zernow *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 153-154 (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

A 3.8-cm-long sample of the bare, 1.3-cm-wide, hollow aluminum alloy strut returned from Surveyor 3 and an equivalent terrestrial sample were examined optically for meteoroid impact. Author

N72-26752*# Air Force Systems Command, Wright-Patterson AFB, Ohio.
SURFACE STUDIES ON SURVEYOR 3 TUBING SECTIONS c31
E. A. Buvinger *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 154-158 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 22B

Sections C and E of the unpainted, polished aluminum tubing from the strut of the radar altimeter and Doppler velocity sensor were examined in a transmission electron microscope for micrometeorite damage and ion bombardment. Both sections were contaminated and eroded on one side; it is suggested that these conditions were caused by sandblasting by lunar dust and retrorocket plume contamination during Surveyor 3 landing. Microcraters of different configurations were found on the bright sides of the tubes. Several degrees of violence were involved in the formation of the craters, and the particle size could be responsible for some differences. All micropits found were on the bright areas and data indicate 0.2 hypervelocity impact/sq cm and 2/sq cm for other types of craters. The greatest degree of damage resulted from particle impact and was limited to a maximum depth of 2 microns. N.E.N

N72-26753*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
RESULTS OF EXAMINATION OF THE RETURNED SURVEYOR 3 SAMPLES FOR PARTICULATE IMPACTS
B. G. Cour-Palais, R. E. Flaherty, R. W. High, D. J. Kessler, D. S. Mckay, and H. A. Zook *In its* Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 158-167 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

The television housing and a section of the strut of the radar altimeter and Doppler velocity sensor were examined optically and with a scanning electron microscope for particulate impacts. The white surface of the camera was discolored during the months the Surveyor 3 was on the moon; however, most of the craters must have occurred as a result of lunar dust sandblasted by the LM exhaust. The polished section of the strut exhibits contamination which appears brown and seems to be partially composed of crystals. Electron microscopic analysis of the strut section indicated no craters of hypervelocity impact origin, confirmed pitting density results of the optical scans, and indicated that material in the craters is of lunar origin. No meteorite impacts larger than 25 microns were detected on the tubing section. N.E.N.

N72-26754*# Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
MICROCRATER INVESTIGATIONS ON SURVEYOR 3 MATERIAL
E. Schneider, G. Neukum, A. Mehl, and H. Fechtig *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 167-172 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

Screws 9 and 23 from Surveyor 3 were examined with a scanning electron microscope for micrometeorite impact features. Six craters on one of the screws appear to be low velocity impact craters, and a flux for about 0.12 sq cm was calculated to be 0.005/sq m/sec for particle diameter > or = 1 micron. Two interpretations are considered: (1) The impacts were produced by interplanetary particles and the flux indicates that deviation from the normal distribution exists only for particles below 1 micron in diameter. (2) Most of the craters were produced by secondary lunar debris, and the flux represents the upper limit for interplanetary particles. N.E.N.

N72-26755*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR SURFACE: CHANGES IN 31 MONTHS AND MICROMETEOROID FLUX
L. D. Jaffe *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 173-176 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

A preliminary comparison of Surveyor 3 and Apollo 12 photographs of areas disturbed by the Surveyor is described. About 60 Surveyor pictures taken in April and May 1967 and 20 Apollo photographs including stereo pairs were examined in detail. Only one definite change in the surface, other than those produced by astronauts, was noted. This is a particle about 2 mm in diameter which appears in the Apollo photographs of a Surveyor footpad imprint but which does not appear in the Surveyor photographs. The walls made by Surveyor footpads and surface sampler were still in place, and surface areas darkened by ejected fines during the Surveyor landing still appeared dark. The absence of detectable craters in the footpad imprint implies a very low micrometeorite flux on the lunar surface. N.E.N.

N72-26756*# Chicago Univ., Ill.
EXAMINATION OF RETURNED SURVEYOR 3 CAMERA VISOR FOR ALPHA RADIOACTIVITY c14
T. E. Economou and A. L. Turkevich *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 177-180 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 14B

The TV camera visor was placed in a vacuum chamber and examined for alpha radioactivity using an alpha-scattering instrument, and plates covered with the same paint and made at the same time as the visor were used as a control. The spectra of visor and plates are very similar, and it is concluded that the gross activity on the visor is due entirely to the activity of the paint. The data were used to obtain the amount of Po-210 activity on the lunar surface. It is felt that the lack of detected alpha radioactivity does not indicate a lack of activity on the moon, since dust layers were knocked off the visor. N.E.N.

N72-26757*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
PRELIMINARY RESULTS ON TRITIUM IN SURVEYOR 3 MATERIAL c24
E. L. Fireman *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 180-184 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 20H

Painted aluminum samples taken from Surveyor 3 were examined for possible tritium implanted by the solar wind. There was found to be a correlation of tritium content with exposure to sunlight. The amount of tritium in sample 1011,2 nearly perpendicular to the lunar surface exceeded the amount expected from the tritium content of lunar rock 12002 by at least a factor of 3. It is concluded that if there is tritium implanted by solar wind on lunar rocks, it is not retained by them. N.E.N.

N72-26758*# United States Steel Corp., Monroeville, Pa.
HIGH VOLTAGE TRANSMISSION MICROSCOPY OF SURVEYOR 3 CAMERA SHROUDS c14
R. M. Fisher, W. R. Duff, L. E. Thomas, and S. V. Radcliffe (Case Western Reserve Univ., Cleveland, Ohio) *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 184-196 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 14B

The internal structure of painted and unpainted aluminum alloy sheet samples from the TV camera shrouds were examined by high-voltage transmission electron microscopy. No clear-cut evidence of radiation damage effects was observed. Noticeable differences in microstructures between the upper visor and the sides and bottom of the lower shroud suggest different thermal histories, and the maximum temperatures due to solar heating are estimated to be between 164 and 319° C. Some correlation between microstructures and maximum estimated temperature is noted. It is felt that the apparent temperature rise due to solar heating will not affect the structural integrity of spacecraft components except possibly for very long periods of exposure. However, substantial thermal diffusion could affect interpretation of solar wind rare gas studies. N.E.N.

N72-26759*# Battelle-Northwest, Richland, Wash.
SOLAR AND GALACTIC COSMIC RAY EXPOSURE OF SURVEYOR 3 AS DETERMINED FROM COSMOGENIC RADIONUCLIDE MEASUREMENTS c29
L. A. Rancitelli, R. W. Perkins, N. A. Wogman, and W. D. Felix *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 196-200 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

The proton-produced Na-22 content of samples of Surveyor 3 TV camera, surface sampler scoop, and other components was determined by nondestructive gamma ray spectrometry. The contributions of the nine most prominent solar flares to Na-22 production were calculated to be 18 dpm/kg. The observed activity in the Surveyor 3 samples was 62 + or - dpm/kg. This indicates a galactic proton contribution of about 44 dpm/kg, which adjusted for spallation of Al gives a value of 42 dpm/kg. This is compared to measurements of 88 dpm/kg in the Lost City meteorite which had an orbit extending to 2.35 AU, with a 4 pi bombardment as compared to the 2 pi bombardment of the samples on the lunar surface. The agreement between Na-22 production in Surveyor 3 and the Lost City meteorite offers evidence that the galactic cosmic ray flux is almost the same at 1 Au and at 2.35 AU. N.E.N.

N72-26760*# Bern Univ. (Switzerland).
SOLAR WIND RARE GAS ANALYSIS: TRAPPED SOLAR WIND HELIUM AND NEON IN SURVEYOR 3 MATERIAL c29
F. Buehler, P. Eberhardt, J. Geiss, and J. Schwarzmueller *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 201-208 refs (See N72-26731 17-30)
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The He-4 and Ne-20 contents in sections of the Surveyor 3 support strut samples were determined by optical and scanning electron microscopy and are compared to the results of the Apollo solar wind composition (SWC) experiments. The He-4/Ne-20 ratio in the samples from the sunlit side of the strut was approximately 300; the ratios determined in Apollo 12 lunar fines and SWC foil were below 100. The He-4/He-3 ratios were also determined, and the ratio obtained from Surveyor 3 material is higher than those found with Apollo 11 and 12 SWC experiments. The effects of spallation by cosmic rays or solar protons, stripping by cosmic ray or energetic solar alpha particles, recycling of solar wind He and radiogenic Ne, He from terrestrial atmosphere, mass discrimination near the moon, mass dependence of trapping probability, diffusion, and contamination by lunar dust are considered. N.E.N.

N72-26761*# Washington Univ., St. Louis, Mo.
SOLAR PARTICLE TRACKS IN GLASS FROM SURVEYOR 3 c29
G. Crozaz (Natl. Belge de la Rech. Sci., France) and R. M. Walker *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 209-212 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

Samples of glass from the Surveyor 3 TV camera filter were examined for particle tracks by optical and scanning electron microscopy. The corrected density value is 1.7 million + or - 0.1 million tracks/sq cm, and the track density vs depth curve is determined. Comparisons with other estimated and calculated data are discussed, and lack of agreement between data sets is considered. It is felt that considerable erosion occurs, and that erosion also occurs by a flaking of small thicknesses of material, possibly caused by solar wind irradiation. N.E.N.

N72-26762*# General Electric Co., Schenectady, N.Y.
VERY HEAVY SOLAR COSMIC RAYS: ENERGY SPECTRUM AND IMPLICATIONS FOR LUNAR EROSION c29
R. L. Fleischer, H. R. Hart, Jr., and G. M. Comstock *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 213-216 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

Particle tracks were investigated in the glass plate of a neutral density (clear flint) optical filter housed in the Surveyor 3 TV camera but exposed directly to space. The track density vs depth curve was determined and descends sharply from approximately 2.6 million tracks/sq cm at a depth of 3.6 mg/sq cm to about 35/sq cm at 700 mg/sq cm. Several tracks were of V-shapes characteristic of high energy induced fission. The erosion rate on the moon due to solar wind ions was determined from the energy spectrum, and was found to be low (0 to 2 x 10 to the minus 8th power cm/yr). N.E.N.

N72-26763*# California Univ., Berkeley.
ENHANCED EMISSION OF IRON NUCLEI IN SOLAR FLARES c29
P. B. Price, I. D. Hutcheon, R. Cowsik (TATA Inst. of Fundamental Res., Bombay), and D. J. Barber *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 217-220 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

A silica glass window from Apollo 12 CM and a piece of flint glass from the Surveyor 3 camera filter were examined for Fe nuclei tracks. A large difference between observed and predicted track densitites was found. At low rigidity (or energy), the solar particle Fe/He ratio is much higher than the photospheric abundance ratio, but decreases with increasing rigidity until it approaches the photospheric value at a rigidity of about 500 MV. It is felt that the low-energy Fe tracks are of solar origin. The implications that heavy nuclei can be preferentially emitted from a source of energetic particles are discussed. Other conclusions are the following: Rocks exposed on the lunar surface for 10 million yr would accumulate about 6 x 10 to the 12th power tracks/sq cm, and the rate of radiation-induced erosion is about 10 to the -9 cm/yr. The lunar soil should contain heavily irradiated small grains, some with track densities of about 10 to the 12th power/sq cm that have flaked from radiation-damaged rock surfaces and some that were irradiated while at the top of the soil layer. N.E.N.

N72-26764*# California Univ., Berkeley.
SOLAR FLARES, THE LUNAR SURFACE, AND GAS RICH METEORITES c29
D. J. Barber, R. Cowsik (TATA Inst. of Fundamental Res., Bombay), I. D. Hutcheon, P. B. Price, and R. S. Rajan *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 221-226 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

Investigations on the Fe-group nuclei track density vs depth in lunar rocks and Surveyor 3 TV camera filter glass were critically examined considering more factors than previously. The analysis gives a firmer basis to the observation of the preferential leakage of low energy Fe nuclei from the accelerating region of the sun. The track density gradients in lunar rock 12022 and filter glass are used to determine the lunar erosion rate of 3 angstroms/yr. Track gradients are less steep than predicted from energy spectrum observed in the Surveyor glass, perhaps due to sputtering. High densities of etchable tracks were found at all depths down to 60 cm in fines from Apollo cores and also in thin sections of the Pesjanoe, Pantar, and Fayetteville gas-rich meteorites. It is felt unlikely that suprathermal heavy ions were responsible for the high track densities. N.E.N.

N72-26765*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BEARING STRENGTH OF THE LUNAR SOIL c13
L. D. Jaffe *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 227-232 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 08M

A discussion is presented on the bearing strength and bearing load-penetration relations in lunar soil. These were measured in air as a function of bulk density. It was found that the relation between bulk density and the logarithm of the bearing capacity is about linear. Shapes of the load vs penetration curves were observed to be similar to those obtained with particulate material of terrestrial origin. K.P.D.

N72-26766*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CRACKING OF THE LUNAR SOIL c13
L. D. Jaffe *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 233-235 (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 08M

Rather than a pattern of cracks in an apparently flat surface, the Apollo 12 photographs suggest an irregular surface that consists of clods or fragments. The impression of flat tiles and crusting, obtained by monoscopic viewing, is an illusion. Instead, the lunar soil deforms and cracks in the same manner as homogeneous isotropic terrestrial soils of moderate bulk density, having a small amount of cohesion. Author

N72-26767*# Washington Univ., Seattle.
WHISKERS ON THE MOON
D. Brownlee, W. Bucher, and P. Hodge *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 236-238 ref (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

The existence of whiskers on lunar soil grains was observed. It is hypothesized that the fibers on these particles are whiskers that grew from clouds of vaporized lunar rock during macro-sized cratering events. K.P.D.

N72-26768*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SURVEYOR 3: BACTERIUM ISOLATED FROM LUNAR RETRIEVED TELEVISION CAMERA c04
F. J. Mitchell (Texas A&M Univ., College Station) and W. L. Ellis *In its* Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 239-248 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 06M

Microbial analysis was the first of several studies of the retrieved camera and was performed immediately after the camera was opened. The emphasis of the analysis was placed upon isolating microorganisms that could be potentially pathogenic for man. Every step in the retrieval of the Surveyor 3 television camera was analyzed for possible contamination sources, including camera contact by the astronauts, ingassing in the lunar and command module during the mission or at splashdown, and handling during quarantine, disassembly, and analysis at the Lunar Receiving Laboratory K.P.D.

N72-26769*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MICROBIOLOGICAL SAMPLING OF RETURNED SURVEYOR 3 ELECTRICAL CABLING c04
M. D. Knittel, M. S. Favero (Public Health Serv., Phoenix, Ariz.), and R. H. Green *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 248-251 refs (See N72-26731 17-30)
Avail: NTIS;SOD $4.00 CSCL 06M

A piece of electrical wiring bundle running from the television camera to another part of the spacecraft was selected for microbiological examination. Sampling methods are discussed. The results presented show that no viable microorganisms were recovered from the part of the Surveyor 3 cable which was tested. Factors that could have contributed to the sterility of the cable are thermal vacuum testing, natural dieoff, change in pressure during launch, and lunar vacuum and temperature. K.P.D.

N72-26770*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT ORIENTATION AND EXPOSURE TO ENVIRONMENT, APPENDIX A
N. L. Nickle *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 253-260 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

Material removed from the spacecraft and returned to earth remained on the lunar surface for 31.9 lunations. None of the returned parts received the maximum 10,686 hours of exposure because of shadowing by the planar array antenna, solar panel, thermal control compartments, or other parts of the spacecraft. To determine the actual exposure of specific parts to sunlight, six series of photographs were taken. A one-fifth-scale model spacecraft was oriented to a collimated light source simulating the orientation of Surveyor with the sun. Three cameras were set up to view different parts of the spacecraft. The data obtained from these photographs permitted an evaluation of the effects of exposure to solar radiation on the camera and its parts, the surface sampling scoop, and the strut from the radar altimeter and Doppler velocity sensor. K.P.D.

N72-26771*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SURVEYOR 3 MATERIAL ANALYSIS PLAN, APPENDIX B
N. L. Nickle and W. F. Carroll *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 261-277 (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 03B

The Surveyor 3 material analysis plan is composed of a series of comprehensive charts of all science and engineering investigations reported. The plan progresses from left to right on each figure. Each test was designed to ensure that the subsequent tests would not be significantly affected by those that preceded it. Each box represents one or more tasks performed by the individual or firm named at the lower left. The upper-right corner shows the amount and type of material subjected to the test or tests listed within the box. Author

N72-26772*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SURVEYOR TELEVISION CAMERA, SELECTED MATERIALS AND ELECTRONIC COMPONENTS, APPENDIX C c14
W. F. Carroll *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 278-283 (See N72-26731 17-30)
Avail: NTIS;SOD $4.00 CSCL 14B

The locations of various parts of the Surveyor camera are presented. Tables were prepared with emphasis on: (1) exterior parts and surfaces that are directly exposed to space, (2) parts that shield others from space radiation, (3) representative or unique materials, and (4) electronic devices that may contain unique or well-characterized materials. Author

N72-26773# Belgian Royal Observatory, Brussels.
PRESENT STATE OF KNOWLEDGE OF INTERSTELLAR MATTER [ETAT ACTUEL DE LA CONNAISSANCE DU MILIEU INTERSTELLAIRE]
P. Cugnon 1971 11 p refs In FRENCH; ENGLISH summary (Commun-Ser-B-60) Avail: NTIS HC $3.00

A general introduction to the field of interstellar matter is presented. The 21-cm hydrogen line observations and their interpretations, and the phenomena of extinction and polarization of starlight are discussed briefly. Author

N72-26774*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MISSION REQUIREMENTS: SECOND SKYLAB MISSION SL-3
1 Feb. 1972 228 p refs Supersedes I-MRD-001C-Rev-4 (NASA-TM-X-68472; Rept-1-MRD-001E-Vol-2; I-MRD-001C-Rev-4) Avail: NTIS HC $13.50 CSCL 22A

Complete SL-3 mission objectives and requirements, as revised 1 February 1972 (Rev. 6), are presented. Detailed test objectives are also given on the medical experiments, Apollo Telescope Mount experiments, Earth Resources Experiment Package, and corollary experiments and environmental microbiology experiments. N.E.N.

N72-26775*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
SOME HIGHER ORDER ANALYSES OF EARTH AND LUNAR ORBITERS
Robert R. Dasenbrock 23 May 1972 131 p refs
(Grant NGL-05-020-007; Contract F33615-70-C-1637; Proj. 5102)
(NASA-CR-126635; SUDAAR-424; AFAL-TR-71-223) Avail: NTIS HC $8.75 CSCL 22C

The accurate modelling of the translational behavior of a drag-free satellite in an almost circular near-earth orbit is investigated. All short and long period position fluctuations in the satellite's coordinates down to 1 m are determined. The general zonal and tesseral harmonic effects are considered as well as lunar and solar effects. A noncanonical approach is followed. A mean orbital plane is chosen so that no short period out-of-plane fluctuations greater than second order occur. Short period radial and cross-track fluctuations and in-track fluctuations are computed. Long period and secular rates of the mean elements which define the slowly varying plane of reference are determined to third order in the small quantities. The equations of motion are integrated analytically away from critical inclination and tesseral resonance. The resonant situation of a sun-synchronous orbit is discussed as a special case. The long-period behavior of a lunar orbiter is also considered, including the effects due to the inclination of the earth's apparent orbit about the moon and those described by Cassini laws on the equations of motion. Both resonant and nonresonant low orbits, and high orbits are discussed. Author

N72-26776# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 278
7 Jun. 1972 26 p refs Transl. into ENGLISH from RUSSIAN reports
(JPRS-56205) Avail: NTIS HC $3.50

Translations and abstracts of articles are presented on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N72-26777*# Tulsa Univ., Okla.
STUDY OF THE GAS CONTENTS OF ROCKS: AN APPROACH TO THE EVOLUTION OF ATMOSPHERES ON THE EARTH AND PLANETS Progress Report, 1 May 1971 - 31 Apr. 1972
Colin Barker May 1972 33 p refs
(Grant NGR-37-008-002)
(NASA-CR-127072) Avail: NTIS HC $3.75 CSCL 03B

A high vacuum system was built for extracting volatiles from rocks either by heating or crushing, and preliminary analyses of the volatiles were made for selected terrestrial basalts and granites. The apparatus and experimental procedures are described, and the major problems associated with water measurement and choice of argon to replace neon as the internal standard are discussed. Preliminary analyses of granites and basalts indicate the following: All analyses lie in the H2O-CO2-CO triangle on a C-H-O ternary diagram. The compositions of the volatiles plot in distinct, but overlapping, areas of the C-H-O diagram. Pre-Cambrian granites have a higher volatile content than younger granites. Continental basalts have a higher volatile content than oceanic basalts. N.E.N.

N72-26778*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE MARINER MARS 1971 MISSION. VOLUME 2: FIRST TRAJECTORY CORRECTION MANEUVER THROUGH ORBIT INSERTION
G. P. Textor, L. B. Kelly, and M. Kelly 15 Jun. 1972 214 p refs
(Contract NAS7-100)
(NASA-CR-127069; JPL-TM-33-523-Vol-2) Avail: NTIS HC $12.75 CSCL 22C

The Deep Space Tracking and Data System activities in support of the Mariner Mars 1971 project from the first trajectory correction maneuver on 4 June 1971 through cruise and orbit insertion on 14 November 1971 are presented. Changes and updates to the TDS requirements and to the plan and configuration plus detailed information on the TDS flight support performance evaluation and the preorbital testing and training are included. With the loss of Mariner 8 at launch, a few changes to the Mariner Mars 1971 requirements, plan, and configuration were necessitated. Mariner 9 is now assuming the former mission plan of Mariner 8, including the TV mapping cycles and a 12-hr orbital period. A second trajectory correction maneuver was not required because of the accuracy of the first maneuver. All testing and training for orbital operations were completed satisfactorily and on schedule. The orbit insertion was accomplished with excellent results. Author

N72-26779# Committee on Science and Astronautics (U. S. House).
MANNED SPACE FLIGHT US-SOVIET RENDEZVOUS AND DOCKING
Washington GPO 1972 31 p Hearing before Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., No. 19, 31 May 1972
Avail: Subcomm. on Manned Space Flight

The hearings before the Subcommittee on Manned Space Flight of the Committee on Science and Astronautics of the U.S. House of Representatives concerning the cooperative manned space flights to be conducted by U.S. and U.S.S.R. are presented. The subjects discussed are: (1) chronology of major events, (2) context of cooperative activities, (3) preliminary mission description, (4) description of various hardware elements, (5) management of engineering phase, and (6) management of real time operation. Diagrams are included to show the approaches taken to obtain compatibility between the systems involved in rendezvous and docking. P.N.F.

N72-26780*# National Aeronautics and Space Administration, Washington, D.C.
THE RINGS OF SATURN
M. S. Bobrov Jun. 1972 133 p refs Transl. into ENGLISH of the book "Kol'tsa Saturna" Moscow, Nauka Press, 1970
(NASA-TT-F-701) Avail: NTIS HC $3.00 CSCL 03B

Present-day knowledge of Saturn's rings is reviewed. The results of observations of Saturn's rings are analyzed in detail, and conclusions as to the nature of the rings are formulated. Particular attention is given to the quantitative theory of change in the brightness of the rings with phase angle, which is then used to estimate the principal physical magnitudes that characterize the rings as a whole, as well as a typical particle of the rings. Questions concerned with the dynamics of the rings are discussed. Author

N72-26781# Lockheed Missiles and Space Co., Palo Alto, Calif.
DETERMINATION OF THE GEOMETRIC SIZE AND DISTRIBUTION OF CRATER OVERCOME BY THE LUNOKHOD-1 ON THE MOON'S SURFACE, CHAPTER 7
B. I. Garin, A. K. Leonovich, F. P. Pavlov, V. B. Georgiev, and P. S. Semenov [1971] 5 p Transl. into ENGLISH from "Peredvizhenaia Laboratoriia na Line-Lunokhod-1" Moscow, Nauka Press, 1971 p 74-77
Avail: NTIS HC $300; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The slopes of the Lunar surface along the 7.3 km path of the Lunokhod 1 are determined from the measurements of the longitudinal and transverse angles of inclination of the chassis.

The lunar surface slopes are obtained as a function of the path traversed with respect to the rover motion, and function of the path traversed with respect to the rover motion, and the geometric size, diameter, depth steepness of sides, and height and width of bank are calculated. The quantity, size, and distribution of different types of craters as determined from Lunokhod 1 data are tabulated along with similar parameters determined from the Luna 17 data. An expression for the distribution of craters of different sizes is given. N.E.N.

N72-26782# Joint Inst. for Nuclear Research, Dubna (USSR).
ACCUMULATION OF COSMOGENIC ISOTOPES IN IRON METEORITES
V. S. Barashenkov, N. M. Sobolevskii, and V. D. Toneev 1972 14 p refs In RUSSIAN
(JINR-P2-6225) Avail: AEC Depository Libraries

The formation rates of cosmogenic isotopes Na-22, Cl-36, K-40, and V-49 in iron meteorites were calculated using the Monte Carlo method. The question about variations of cosmic ray intensities is discussed. Preatmospheric radius of the Arus-Yardymlinsky meteorite was estimated. The results were compared with those previously obtained. Author (NSA)

N72-26783# Rome Univ. (Italy). School of Aerospace Engineering.
DETERMINATION OF AN ACCURATE REFERENCE ORBIT FOR THE COMPARISON OF ORBIT COMPUTATION ROUTINES. APPLICATION TO THE CRA ROUTINE: ORBIT 3 [GENERAZIONE DI UN'ACCURATA ORBITA DI RIFERIMENTO PER IL CONFRONTO DI ROUTINES ORBITALI. APPLICAZIONE AL CASO DELLA ROUTINE CRA. ORBIT 3]
Severino Giorei and Carlo Arduini Jul. 1971 35 p refs In ITALIAN; ENGLISH summary
(Rept-38) Avail: NTIS HC $3.75

A high precision reference method for the calculation of orbital parameters (modified Encke's method) is defined. The program flow charts for the reference method (processed by an IBM-1130 computer) is given, and graphs and numerical results for the comparison with the simplified routine are included. Author (ESRO)

N72-26784# Royal Greenwich Observatory, Herstmonceux (England).
THE EQUIVALENT WIDTHS OF SPECTRAL LINES IN TWELVE LATE F DWARFS
A. L. T. Powell 1971 15 p refs *Its* Roy. Obs. Bull. No. 167 Prepared jointly with Roy. Obs. Capetown
Avail: NTIS HC $3.00; Roy. Greenwich Obs., Herstmonceux £0.25

Equivalent widths for the spectral lines of twelve late F dwarfs are given for use in curve of growth analysis and an accurate set of elemental abundance determinations obtained. The blue wavelength spectrograms were obtained on the 30 in. conde at Herstmonceux and the red on the 100 in. Mount Wilson conde. Author (ESRO)

N72-26785# Royal Greenwich Observatory, Herstmonceux (England).
SPECTRAL LINES FOR CURVE-OF-GROWTH ANALYSIS OF LATE-TYPE STARS, PART 1
A. L. T. Powell 1971 36 p refs *Its* Roy Obs. Bull. No. 168 Prepared jointly with Roy Obs. Capetown
Avail: NTIS HC $4.00; Roy. Greenwich Obs., Herstmonceux £0.50

Spectral line constants for late stars are given in the form of tables, together with some equivalent widths and their desaturated values for the bifurcated and unbifurcated case. The tables are to be updated at intervals. Author (ESRO)

N72-26786# Royal Greenwich Observatory, Herstmonceux (England).
MASSES, RADII AND LUMINOSITIES OF RR LYRAE VARIABLE STARS
Richard Woolley and Ann Savage 1971 34 p refs Prepared jointly with Roy Obs. Capetown
(Bull-170) Avail: NTIS HC $3.75; Roy. Greenwich Obs., Herstmonceux £0.50

The Baade-Wesselink method of determining radii of variable stars is examined. The idea is introduced that specific intensity in B and V is affected by gravity as well as by temperature, so that it is necessary to take into account the accelerations which occur at certain phases in the pulsation cycle and the mass of the star. The Badde-Wesselink method is incomplete as a means of determining radius and absolute magnitude. It is suggested that observations in I may supply the missing data. The stars are classified according to period and period-luminosity criteria, and the main findings are given. The galactic orbits are calculated, assuming an inverse square attracting field. About half the orbits of stars are retrograde, and the median eccentricity of these is very high. Other stars describe orbits not dissimilar to those of late-type nearby stars. Author (ESRO)

N72-26787# European Space Research Inst., Frascati (Italy).
PRECISION MEASUREMENT OF THE SUN'S GRAVITATIONAL FIELD BY MEANS OF THE TWIN PROBE METHOD
Bruno Bertotti and Giuseppe Colombo (Padua-Univ.) 31 Jan. 1972 30 p refs Submitted for publication
Avail: NTIS HC $3.75

To eliminate the effect of nongravitational forces (mainly the solar radiation pressure), two twin space probes are proposed with a surface having identical geometrical and optical properties, but with different mass. Their differential motion leads to the motion determination of an ideal geodesic point. The various conditions which are needed to ensure the required degree of identity are discussed, and as a possible solution, two cylindrical probes are proposed, whose sides are covered by cavities to make them absorbent. The accuracy in parameter determination of the metric field of the sun obtainable from range measurements is briefly discussed. Author (ESRO)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N72-26788*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
DESIGN GUIDE FOR LOW COST STANDARDIZED PAYLOADS, VOLUME 1
30 Apr. 1972 129 p
(Contract NASw-2312)
(NASA-CR-127115; LMSC-D154696-Vol-1) Avail: NTIS HC $8.50 CSCL 22B

Concept point designs of low cost and refurbishable spacecraft, subsystems, and modules revealed payload program savings up to 50 percent. The general relationship of payload approaches to program costs; cost reductions from low cost standardized payloads; cost effective application of payload reliability, MMD, repair, and refurbishment; and implementation of standardization for future spacecraft are discussed. Shuttle interfaces and support equipment for future payloads are also considered J.A.M.

N72-26789*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
DESIGN GUIDE FOR LOW COST STANDARDIZED

PAYLOADS, VOLUME 2
30 Apr. 1972 531 p
(Contract NASw-2312)
(NASA-CR-127116; LMSC-D154696-Vol-2) Avail: NTIS HC $28.75 CSCL 22B

Sixteen engineering approaches to low cost standardized payloads in spacecraft are presented. Standard earth observatory satellite, standard U.S. domestic communication satellite, planetary spacecraft subsystems, standard spacecraft, and cluster spacecraft are reviewed. J.A.M.

N72-26790*# Aerospace Corp., El Segundo, Calif. Advanced Vehicle Systems Directorate.
INTEGRATED OPERATIONS/PAYLOADS/FLEET ANALYSIS. VOLUME 1: SUMMARY, STUDY OVERVIEW Final Report, Jul. 1970 - Jun. 1971
Aug. 1971 30 p refs
(Contract NASw-2129)
(NASA-CR-125984; ATR-72(7231)-1-Vol-1) Avail: NTIS HC $3.50 CSCL 22B

The preparation of payload input data for analysis, and the capture and cost analyses are described for the current fleet, a low cost expendable fleet, and the space shuttle/space tug fleet. The data preparation consisted of formatting, extending, and correcting the input data which were broken down in terms of satellite gross weight. The results of the analyses indicate a significant reduction in the required total number of new payload units for the space shuttle/space tug fleet. Another result is that 26% of the payloads for the new low cost expendable fleet and 26% for the space shuttle/space tug fleet are of low cost payload designs. N.E.N.

N72-26791*# Aerospace Corp., El Segundo, Calif. Advanced Vehicle Systems Directorate.
INTEGRATED OPERATIONS/PAYLOADS/FLEET ANALYSIS. VOLUME 2: PAYLOADS Final Report
Aug. 1971 214 p refs
(Contract NASw-2129)
(ATR-72(7231)-1-Vol-2; NASA-CR-126740) Avail: NTIS HC $12.75 CSCL 22B

The payloads for NASA and non-NASA missions of the integrated fleet are analyzed to generate payload data for the capture and cost analyses for the period 1979 to 1990. Most of the effort is on earth satellites, probes, and planetary missions because of the space shuttle's ability to retrieve payloads for repair, overhaul, and maintenance. Four types of payloads are considered: current expendable payload; current reusable payload; low cost expendable payload, (satellite to be used with expendable launch vehicles); and low cost reusable payload (satellite to be used with the space shuttle/space tug system). Payload weight analysis, structural sizing analysis, and the influence of mean mission duration on program cost are also discussed. The payload data were computerized, and printouts of the data for payloads for each program or mission are included. N.E.N.

N72-26792*# Aerospace Corp., El Segundo, Calif. Advanced Vehicle Systems Directorate.
INTEGRATED OPERATIONS/PAYLOADS/FLEET ANALYSIS. VOLUME 3: SYSTEM COSTS Final Report
Aug. 1971 632 p refs
(Contract NASw-2129)
(NASA-CR-123414; ATR-72(7231)-1-Vol-3) Avail: NTIS HC $33.75 CSCL 22B

The estimates of life cycle costs of all space system elements are presented. These include cost estimates for the launch system, payload system, and launch vehicle reliability and payload impact mortality. The total space program cost estimates for six systems were prepared, based on the life cycle estimates. Annual funding levels required for the total space program indicate a peak funding level of $3.61 billion when the space transportation system is used. This compares to a peak value of $4.07 billion when current launch vehicles are used. Total direct costs incurred by user agencies are also presented. Total direct cost savings of approximately $14 billion are possible when the space transportation system is used instead of current expendible launch vehicles. Author

N72-26793*# Aerospace Corp., El Segundo, Calif. Advanced Vehicle Systems Directorate.
INTEGRATED OPERATIONS/PAYLOADS/FLEET ANALYSIS. VOLUME 3: SYSTEM COSTS. APPENDIX A: PROGRAM DIRECT COSTS Final Report
Aug. 1971 436 p
(Contract NASw-2129)
(NASA-CR-123382; ATR-72(7231)-1-Vol-3-App-A) Avail: NTIS HC $24.00 CSCL 22B

Individualized program direct costs for each satellite program are presented. This breakdown provides the activity level dependent costs for each satellite program. The activity level dependent costs, or, more simply, program direct costs, are comprised of the total payload costs (as these costs are strictly program dependent) and the direct launch vehicle costs. Only those incremental launch vehicle costs associated directly with the satellite program are considered. For expendable launch vehicles the direct costs include the vehicle investment hardware costs and the launch operations costs. For the reusable STS vehicles the direct costs include only the launch operations, recovery operations, command and control, vehicle maintenance, and propellant support. The costs associated with amortization of reusable vehicle investment, RDT&E range support, etc., are not included. Author

N72-26794*# Aerospace Corp., El Segundo, Calif. Advanced Vehicle Systems Directorate.
INTEGRATED OPERATIONS/PAYLOADS/FLEET ANALYSIS. VOLUME 4: LAUNCH SYSTEMS Final Report
Aug. 1971 282 p refs
(Contract NASw-2129)
(NASA-CR-121483; ATR-72(7231)-1-Vol-4) Avail: NTIS CSCL 22B

Descriptive information and detailed data for the launch systems are presented. The vehicle systems covered are the current fleet of launch vehicles; a family of new low cost expendable launch vehicles; the two-stage, fully reusable space shuttle; the space tug; and resuable nuclear shuttle. The data cover configuration and vehicle/subsystem descriptions; performance and weights; development; and payload environments and interfaces. A description of each of the vehicle systems, based on their best definitions in March and April 1971, is presented. Author

N72-26795*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
EXPERIMENTAL EVALUATION OF THREE LEAK DETECTION AND LOCATION CONCEPTS FOR SPACE STATIONS Final Report
M. V. Scherb, G. P. Kazokas, J. A. Zelik, J. R. Mastandrea, and D. C. MacKallor Jun. 1972 254 p refs
(Contract NAS1-10840)
(NASA-CR-112066; MDC-G2911) Avail: NTIS HC $14.75 CSCL 22B

Three leak (or precursor damage modes) detection and location concepts for space station overboard leakage were evaluated experimentally. The techniques are: (1) static and dynamic seal leak detector sensing of moisture or all gases in space cabin atmosphere, (2) active ultrasonic Lamb-wave detection of flaws or cracks in cabin wall, and (3) impact gage detection of stress waves induced in cabin pressure wall by meteoroid or orbital impact. The experimental results obtained in the program demonstrated that all three leak detection and location concepts are feasible. With further development, the methods can be integrated into an effective damage control system for advanced manned earth-orbital systems. Author

N72-26796*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
BIORESEARCH MODULE DESIGN DEFINITION AND SPACE SHUTTLE VEHICLE INTEGRATION. VOLUME 1: TECHNICAL REPORT Final Report
15 Dec. 1971 164 p refs 3 Vol.
(Contract NAS2-6523)
(NASA-CR-114408; GE-RESD-N-72469-Vol-1) Avail: NTIS HC $10.25 CSCL 22B

The baseline preliminary design developed for the Bioexplorer spacecraft under a previous contract was used, and further study effort devoted in areas of thermal control, attitude control, and power subsystem design. The use of the space shuttle vehicle as a potential launch and recovery vehicle for the Bioresearch module was also evaluated. Author

N72-26797*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
BIORESEARCH MODULE DESIGN DEFINITION AND SPACE SHUTTLE VEHICLE INTEGRATION. VOLUME 2: PRELIMINARY BIORESEARCH MODULE DEVELOPMENT PROGRAM PLAN Final Report
15 Dec. 1971 103 p refs 3 Vol.
(Contract NAS2-6523)
(NASA-CR-114409; GE-RESD-N-72469-Vol-2) Avail: NTIS HC $7.25 CSCL 22B

The planning, schedules, direction, and management necessary to effectively perform the design, development, evaluation, and flight of two type 1 and two type 2 bioresearch modules are described. Author

N72-26798*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
BIORESEARCH MODULE DESIGN DEFINITION AND SPACE SHUTTLE VEHICLE INTEGRATION. VOLUME 3: MANAGEMENT AND FUNDING PLAN Final Report
15 Dec. 1971 47 p refs 3 Vol.
(Contract NAS2-6523)
(NASA-CR-114410; GE-RESD-N-72469-Vol-3) Avail: NTIS HC $4.50 CSCL 22B

A description is given of the proposed project organization, documentation and reports, project planning, direction and control, related experience and facilities, and cost estimate data and options for the implementation of the bioresearch module development program. Author

N72-26799*# Vought Missiles and Space Co., Dallas, Tex.
BIORESEARCH MODULE DESIGN DEFINITION AND SPACE SHUTTLE VEHICLE INTEGRATION STUDY. VOLUME 1: BASIC REPORT Final Progress Report
A. L. Lang, Jr. 17 Dec. 1971 160 p refs 2 Vol.
(Contract NAS2-6524)
(NASA-CR-114411; T146-4-Vol-1) Avail: NTIS HC $10.00 CSCL 22B

Preliminary designs of the Bioexplorer spacecraft, developed in an earlier study program, are analyzed and updated to conform to a new specification which includes use of both the Scout and the space shuttle vehicle for launch. The updated spacecraft is referred to as bioresearch module. It is capable of supporting a variety of small biological experiments in near-earth and highly elliptical earth orbits. The baseline spacecraft design is compatible with the Scout launch vehicle. Inboard profile drawings, weight statements, interface drawings, and spacecraft parts and aerospace ground equipment lists are provided to document the design. The baseline design was analyzed to determine the design and cost impact of a set of optional features. These include reduced experiment power and thermal load, addition of an experiment television monitor, and replacement of VHF with S-band communications. The impact of these options on power required, weight change and cost is defined. Author

N72-26800*# Vought Missiles and Space Co., Dallas, Tex.
BIORESEARCH MODULE DESIGN DEFINITION AND SPACE SHUTTLE VEHICLE INTEGRATION STUDY. VOLUME 2: APPENDICES Final Progress Report
A. L. Lang, Jr. 17 Dec. 1971 189 p refs 2 Vol.
(Contract NAS2-6524)
(NASA-CR-114412; T146-4-Vol-2) Avail: NTIS HC $11.50 CSCL 22B

Data presented in the appendices covers: (1) summary description of baseline power system; (2) revised thermal profile analysis; (3) design analysis of television monitor; (4) bioresearch module ground station support evaluation; (5) variable spin control analysis; and (6) bioresearch modules and work flow. A.L.

N72-26801*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: AERODYNAMIC CHARACTERISTICS OF CONE-CYLINDER-FLARE-FIN CONFIGURATIONS AT MACH NUMBERS OF 1.96, 2.74, AND 4.96 AND ANGLES OF ATTACK FROM 50 TO 90 DEGREES
Dale Bradley and R. Ellis Jun. 1972 253 p
(Contract NAS8-4016)
(NASA-CR-120042; DMS-DR-1242; NASA-Ser-S-1048) Avail: NTIS HC $14.75 CSCL 22B

A 0.00227-scale parametric model of an LMSC/MSFC water recoverable booster was tested in the MSFC 14 x 14-inch trisonic wind tunnel. The purpose of the test was to obtain high angle of attack force and static stability data which could be used by MSFC in preliminary design and aerodynamic trade studies. These data were obtained using six-component internal strain gauge balances. One hundred forty-four different geometrical combinations were possible as all model parts were interchangeable (three nose cones, three cylinder lengths, four flare sections and three sets of fins, plus a no-fin case in combination with the other components). However, due to tunnel occupancy limitations, only the most representative combinations were tested. All configurations investigated were tested at Mach 1.96, 2.74 and 4.96 with data obtained at angles of attack from 50 degrees to 90 degrees and at angles of sideslip from -10 degrees to +10 degrees (at an angle of attack of 60 degrees). Author

N72-26802*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: STATIC AERODYNAMIC CHARACTERISTICS AND CONTROL EFFECTIVENESS OF THE GAC H-33 ORBITER AT MACH NUMBERS FROM 0.6 TO 4.96
R. Krepski, M. Quan, A. Francario, and K. Blackwell Jun. 1972 223 p
(Contract NAS8-4016)
(NASA-CR-120013; DMS-DR-1184) Avail: NTIS HC $13.25 CSCL 22B

A .003366 scale model of the Grumman H-33 orbiter was tested in the MSFC 14 inch Trisonic Wind Tunnel. Six-component aerodynamic force and moment data was recorded over a Mach number range of 0.6 to 4.96. Both pitch runs and yaw runs at various constant angles of attack were completed. The basic model configuration was investigated. The effects of a component build-up and of various control deflections were obtained. The elevons were deflected symmetrically and asymmetrically to determine elevator and aileron effectiveness. The rudder was tested both flared and unflared and the effects of deflections were determined in the flared case. The model was tested in pitch in two intervals. The first interval was from 0 to 20 deg. Then an adaptor was set to give the sting an offset angle and 20 to 40 deg angle of attack was obtained. Characteristics in sideslip were determined by varying sideslip angle from -4 deg to 10 deg with angle of attack set at 0 deg, 10 deg, 15 deg, and 30 deg. Author

N72-26803*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE: REENTRY STABILITY AND PERFORMANCE CHARACTERISTICS IN THE TRANSONIC AND SUPERSONIC FLIGHT REGIMES OF THE BOEING

BALLISTIC RECOVERABLE BOOSTER
Jacque Houser and S. Vanderleest Jun. 1972 438 p
(Contract NAS8-4016)
(NASA-CR-120069; DMS-DR-1228; NASA-Ser-S-0622) Avail: NTIS HC $24.00 CSCL 22B

Experimental aerodynamic investigations were made in transonic and supersonic wind tunnels on a .008899 scale model of the Boeing model 979-145 Ballistic Recoverable Booster. The purpose of the tests was to define the stability and performance characteristics of the BRB at re-entry attitudes in the transonic and supersonic flight regimes. Data were obtained over a Mach number range from 0.6 to 4.0 at angles of attack between 50 deg and 85 deg at zero sideslip and at angles of sideslip between -17.5 deg and +15 deg at angles of attack between 50 deg and 85 deg. Author

N72-26804*# Teledyne Brown Engineering, Huntsville, Ala.
SKYLAB EXPERIMENT PERFORMANCE EVALUATION MANUAL. APPENDIX K: EXPERIMENT S009 NUCLEAR EMULSION (MSFC)
J. E. Meyers 31 Mar. 1972 86 p refs
(Contract NAS8-21804)
(NASA-CR-61386) Avail: NTIS HC $6.50 CSCL 22B

A series of analyses are presented for Experiment S009, nuclear emulsion (MSFC), to be used for evaluating the performance of the Skylab corollary experiments under preflight, inflight, and postflight conditions. Experiment contingency plan workaround procedure and malfunction analyses are included in order to assist in making the experiment operationally successful. Author

N72-26805*# Techtran Corp., Glen Burnie, Md.
SPACE PHYSICS AND SPACECRAFT
G. A. Skuridin Washington NASA Jun. 1972 73 p Transl. into ENGLISH from Kosmich. Fiz. i Kosmich. (Moscow), 1970
(Contract NASw-2037)
(NASA-TT-F-703) Avail: NTIS HC $3.00 CSCL 22A

A historical review of the study of solar-terrestrial relationships is presented. Among the topics in this section are: (1) the Chapman-Parker theory, (2) the origin of the solar wind, (3) the model of the interplanetary medium, along with the Earth's magnetic field and magnetic storms, (4) the Chapman-Ferraro theory of magnetic storms, (5) the structure of the geomagnetic field, and (6) a model of the Earth's magnetosphere. In addition the earth's radiation belt, the measurement of the low-energy plasma and the knee effect, the magnetosphere boundary and the dynamics of charged particles, the ring current of magnetic storms, polar aurorae, and the interaction of geophysical phenomena and their origin are discussed. A historical review of USA and USSR manned and unmanned spacecraft is developed. Among the topics discussed in detail are the USSR's Kosmos, Elektron, Proton, and Zond unmanned spacecraft series. The US space program is concisely described. Author

N72-26806*# Translation Consultants, Ltd., Arlington, Va.
THE CONDUCT OF THE EOLE EXPERIMENT
J. L. Muller Washington NASA Jun. 1972 9 p Transl. into ENGLISH of CNES conf. paper Presented to Cospar, Session 2, Working Group 6, Paper J-9, 1972 9 p
(Contract NASw-2038)
(NASA-TT-F-14534; J-9) Avail: NTIS HC $3.00 CSCL 22C

The EOLE meteorological experiment, connecting a data acquisition and localization satellite with a flotilla of 500 balloons flying at 12,000 m in altitude in the Southern Hemisphere, began on 16 August 1971, and has continued successfully up until now. The general conditions under which the experiment progressed are reported and the difficulties encountered are revealed, especially in the field of balloons which formed the most original part of the project. Author

N72-26807*# Allied Research Associates, Inc., Concord, Mass.
THE NIMBUS 4 DATA CATALOG. VOLUME 5: 1 NOVEMBER - 31 DECEMBER 1970, DATA ORBITS 2776-3594
Jun. 1971 197 p refs
(Contract NAS5-21617; Proj. Nimbus)
(NASA-CR-122428) Avail: NTIS HC $12.00 CSCL 22A

A catalog of data acquired from the Nimbus 4 meteorological satellite is presented. The volume covers the period 1 November through 31 December 1970. The Nimbus 4 catalog presents the type of data available, anomalies in the data, and geographic location and time of the data. The subjects discussed are: (1) summary of operations, (2) orbital elements and daily sensors on table, (3) image dissector camera system montages, and (4) temperature-humidity infrared radiometer montages. Author

N72-26808# Joint Publications Research Service, Arlington, Va.
INTERKOSMOS-4 SPACE OBSERVATIONS AND INSTRUMENTS
B. I. Valnicek, I. P. Tindo, and B. Stark 23 Jun. 1972 13 p Transl. into ENGLISH from Zemlya Vselennaya (Moscow), no. 6, Nov.-Dec. 1971 p 16-21
(JPRS-56341) Avail: NTIS HC $3.00 CSCL 22C

Descriptive data are presented covering long range flight of the Intercosmos 4 satellite. A description of onboard instruments for investigation solar short wave radiation is included. Author

N72-26809*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS OF SOME MODIFIED CONICAL BODIES WITH LOW LIFT-DRAG RATIOS AT MACH NUMBERS OF 2.30 AND 4.63
Edwin E. Davenport Washington Jul. 1972 28 p refs
(NASA-TM-X-2583; L-8239) Avail: NTIS HC $3.00 CSCL 01A

A wind-tunnel investigation was conducted at Mach numbers of 2.30 and 4.63 to determine the static aerodynamic characteristics of three 60 deg half-angle cone models. Configuration 1 was obtained by raking off a symmetrical cone at a base angle of 6.15 deg, and configuration 2 and 3 were obtained by adding flaps to a symmetrical cone. The models were tested at angles of attack from about -5 deg to about 20 deg at roll angles of 0 deg to -180 deg and at a freestream Reynolds number of 1.09 x one million, based on body diameter. The results showed that all three configurations produced finite values of lift-drag ratio useful for lifting planetary entry. All three configurations exhibited increases in yawing moment and side force with roll angle; thus, the capability for lateral trajectory control is provided. Author

N72-26810*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH ROCKET TESTS RR-1 (BLACK BRANT VC) AND RR-2 (AEROBEE 170A): INVESTIGATIONS OF THE STABILITY OF BUBBLES IN PLAIN AND FIBER-REINFORCED METAL MELTED AND SOLIDIFIED IN A NEAR-ZERO-g ENVIRONMENT
I. C. Yates and Vaughn H. Yost 28 Apr. 1972 66 p
(NASA-TM-X-64665) Avail: NTIS HC $5.50 CSCL 19G

The results of the first two of a series of research rocket flights are presented. The objectives of these flights were: (1) to learn about the capabilities of these rockets, (2) to learn how to interface the payloads and rockets, and (3) to process some of the composite casting demonstration capsules intended originally for Apollo 15. The capsules contained experiments for investigating the stability of gas bubbles in plain and fiber-reinforced metal melted and solidified in a near-zero-g (0.0119g) environment. The characteristics of the two research rockets, an Aerobee 170A and a Black Brant VC, used to obtain the periods of near-zero-g and the temperature control unit used for processing the contents of the two experiment capsules are discussed. Flight data for the Aerobee 170A NASA 13.113 are presented and analyzed. Author

N72-26811*# National Aeronautics and Space Administration, Washington, D.C.
EARTH RESOURCES TECHNOLOGY SATELLITES A (ERTS-A): PRESS KIT
20 Jul. 1972 99 p
(NASA-TM-X-68489) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22B

The ERTS-A spacecraft, instruments, and mission are described along with the general ERTS program and coordinated interagency activities. The 891-kg ERTS-A is to be launched into a 920-km circular, sun-synchronous, near-polar orbit. The main purpose of the first mission is to demonstrate the usefulness of remote sensing of the earth's surface. This includes determining the most suitable natural and cultural resource and environmental data to acquire, demonstrating acquisition procedures and interpretive techniques, and determining how repetitive, synoptic, multispectral observations can be of economic or social value. The main instruments are return beam vidicon TV cameras, a multispectral scanner subsystem, a data collection system, and wideband tape recorders. Ultimately, the ERTS satellites will provide data to aid studying and planning in the areas of agriculture, forestry, geology, hydrology, oceanography, geography, meteorology, and environmental quality and ecology. All investigators from the United States, 31 other nations, and two international organizations will have access to all data.
N.E.N.

N72-26812# Rome Univ. (Italy). School of Aeronautical Engineering.
REMOTE ATTITUDE SENSING TECHNIQUE FOR SPACE APPLICATIONS
Giorgio Ravelli Nov. 1970 30 p refs Presented at the 21st Intern. Astronautical Congr., Constance, West Ger., 4-10 Oct. 1970
(Rept-31) Avail: NTIS HC $3.50

An attitude sensing system is described, enabling the pointing of a narrow beam communication satellite antenna to a specific earth terminal. The system uses a spacecraft transmitter of coded radio signals, which when received at the earth terminal provides a nonambiguous function of the spacecraft attitude angles with respect to the line of sight to the terminal itself. This solution permits a significant reduction of the complexity of the onboard equipment. The proposed system behaves like a monopulse system in which the receiving and transmitting functions are interchanged. The monopulse techniques are described, and errors and noise problems are surveyed.
Author (ESRO)

N72-26813# Atmospheric Sciences Office, White Sands Missile Range, N.Mex.
UNGUIDED ROCKET IMPACT DISPERSION AT WHITE SANDS MISSILE RANGE, NEW MEXICO Meteorological Data Report
Gordon L. Dunaway and Majorie McLardie Hoidale Feb. 1972 46 p refs
(DA Proj. 1T6-65702-D-127)
(AD-738848; DR-689) Avail: NTIS CSCL 19/4

Impact dispersion data are presented for the following unguided sounding rockets launched from White Sands Missile Range, New Mexico, or the Utah Launch Complex, Green River, Utah, during 1965-1971: Aerobee-350, Aerobee-170, Aerobee-170A, Aerobee-150, Athena (Second Stage), Athena H (First Stage), Nike-boosted rockets (Hydac, Javelin, Iroquois, Apache, Apache Nicap, Cajun), Met RDT-E, Viper Loki, ARCAS, and Boosted ARCAS (Boosted I, Boosted II, HVAR, Sidewinder, and Sparrow).
Author (GRA)

N72-26814# ARO, Inc., Arnold Air Force Station, Tenn.
ABORT SEPARATION, LONGITUDINAL FORCE, AND MOMENT CHARACTERISTICS OF MCDONNELL DOUGLAS BOOSTER AND ORBITER SPACE SHUTTLE VEHICLES AT MACH NUMBERS 2.0 TO 6.0 Final Report
R. H. Burt AEDC Mar. 1972 409 p refs
(Contract F40600-72-C-0003; AF Proj. 921E; ARO Proj. VA116321)
(AD-738645; ARO-VKF-TR-71-196; AEDC-TR-72-11) Avail: NTIS CSCL 22/2

Results are presented for abort staging wind tunnel tests which were conducted to determine the aerodynamic characteristics of the McDonnell Douglas booster and orbiter configurations in close proximity. Data were obtained on both scale models over an angle-of-attack range from -10 to +10 deg for zero slideslip angle. Orbiter incidence angle relative to the booster was varied from -10 to +10 deg which provided an orbiter angle-of-attack range from -20 to +20 deg. The models were tested at Mach numbers from 2.0 to 6.0 at several separation distances and power conditions. An annular cold-flow nozzle in each model was used to simulate booster and orbiter plumes at various altitudes along a proposed ascent trajectory. Plume simulation for 100, 50, and 0 percent of full power for the booster and 100, 50, 25, and 1 percent of full power for the orbiter was investigated, with 50-percent booster and 100-percent orbiter power as the nominal conditions. Pitch control effectiveness data were obtained for both booster and orbiter with power on and off. In addition, data were obtained with and without booster power simulation on a proposed launch configuration where the orbiter was physically attached to the booster, and a single balance in the booster model was utilized. A complete set of plotted data for each vehicle at each test condition is included.
Author (GRA)

N72-26874*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECTS OF VARIOUS PARAMETERS ON SPACECRAFT SEPARATION SHOCK
W. Brian Keegan and William F. Bangs *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 131-148 ref (See N72-26860 17-32)
(NASA-TM-X-68467) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 22B

N72-26880*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
VIBRATION FIXTURING: NEW CELLULAR DESIGN, SATURN AND ORBITAL WORKSHOP PROGRAMS
Russell L. Stafford *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jul. 1972 p 205-208 refs Sponsored by NASA (See N72-26860 17-32)
(NASA-CR-127084) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 22B

N72-26384*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
NEUTER DOCKING MECHANISM STUDY
James C. Jones *In its* 6th Aerospace Mech. Symp. Jun. 1972 p 43-49 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 22B

N72-26386*# TRW Systems Group, Redondo Beach, Calif.
PIONEER F/G APPENDAGE DEPLOYMENT
G. V. Hesprich *In* NASA. Ames Res. Center 6th Aerospace Mech. Symp. Jun. 1972 p 57-63 (See N72-26377 17-15)
(Contract NAS2-5600)
Avail: NTIS HC $3.00 CSCL 22B

N72-26392*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GAS-POWERED REENTRY BODY ERECTION MECHANISM
Ralph J. Muraca and Kenneth D. Hedgepeth *In its* 6th Aerospace Mech. Symp. Jun. 1972 p 101-107 (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 22B

N72-26398*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DOCKING DEVICES FOR SOYUZ-TYPE SPACECRAFT
V. S. Syromyatnikov *In its* 6th Aerospace Mech. Symp. Jun. 1972 p 143-150 ref (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 22B

N72-26752*# Air Force Systems Command, Wright-Patterson AFB, Ohio.
SURFACE STUDIES ON SURVEYOR 3 TUBING SECTIONS
E. A. Buvinger *In* NASA, Washington Analysis of Surveyor 3 Mater. and Phot. Returned by Apollo 12 1972 p 154-158 refs (See N72-26731 17-30)
Avail: NTIS; SOD $4.00 CSCL 22B

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N72-26815 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN, NO. 42. PART 1: INVITED PAPERS, SPECIFICATIONS, MECHANICAL IMPEDANCE, TRANSPORTATION AND PACKAGING
Conference Proceedings
Jan. 1972 257 p refs Presented at 42d Symp. on Shock and Vibration, Key West, Fla., 2-4 Nov. 1971 5 Vol.
(AD-739574; Bull-42-Pt-1) Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C: HC $40.00 per set CSCL 20/11

Conference papers on shock and vibration are presented that deal with the related areas of standards and specifications, measurement and application of mechanical impedance, and transportation and packaging. For individual titles, see N72-26816 through N72-26835.

N72-26816 Naval Ship Engineering Center, Hyattsville, Md.
SMALL SHIPS - HIGH PERFORMANCE
Harry C. Mason *In* Shock and Vibration Inform Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 1-9 (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The design and operational characteristics of small, high performance ships of the U.S. Navy are discussed. Emphasis is placed on hydrofoils and air cushion vehicles. Consideration is given to those types of ships which are now in existence and those being contemplated for the future. The problems involved in the interfacing of weapon systems with these vehicles are included in the discussion. D.L.G.

N72-26817 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
SURVEY OF VIBRATION TEST PROCEDURES IN USE BY THE AIR FORCE
Wayne B. Yarcho *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 11-17 ref (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A survey was conducted of specifications and standards containing vibration test procedures in use by the Air Force, to assess progress toward the establishment and maintenance of uniform procurement guidelines. A representative sample of hardware specifications selected from the DOD Specification Index was examined to establish the direction and extent of use of vibration tests offered in the various test specifications and standards. A number of documents presenting vibration test methods were reviewed to determine what procedures are available for application to hardware items. Conclusions relative to the current status of vibration testing methods are presented. Author

N72-26818 Shock and Vibration Information Center (Defense), Washington, D.C.
SPECIFICATIONS: A PANEL SESSION
In its The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 19-32 (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The proceedings are presented of a panel discussion on the effectiveness of specifications and standards relating to shock and vibration. The discussion centers around the experiences of the various branches of the military in applying these specifications and standards to their individual requirements. Problems of interpretation are stressed along with difficulties encountered in misuse and overuse. Numerous approaches to these problems are considered. D.L.G.

N72-26819 Naval Ship Engineering Center, Hyattsville, Md.
SOME ADMINISTRATIVE FACTORS WHICH INFLUENCE TECHNICAL APPROACHES TO SHIP SHOCK HARDENING
Donald M. Lund *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 33-42 (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Administratively oriented factors which are of importance to the Navy's ship shock hardening effort are briefly reviewed. Emphasis of the discussion is given to three basic administration factors: procurement policies, cost considerations, and scheduling considerations. Technological trends which have developed in the need for improved ship shock resistance are mentioned and suggestions are made of means by which the technical community can contribute to the ship hardening effort. D.L.G.

N72-26820 Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
FORCE TRANSDUCER CALIBRATIONS RELATED TO MECHANICAL IMPEDANCE MEASUREMENTS
E. F. Ludwig and N. D. Taylor *In* Shock and Vibration Inform. Center The Shock and Vibration Bull, No. 42, Pt. 1 Jan. 1972 p 43-54 refs (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Two different transducer characteristics are reviewed for consideration in evaluating force transducer calibrations. The first characteristic examined is that of amplitude linearity and sensitivity deviation. A standardizing procedure for amplitude linearity calibration is proposed. The calibration is performed by vibrating the transducer at various acceleration levels with a known mass attached and measuring its output signal. The second transducer characteristic considered involves base strain sensitivity. The method suggested for evaluation consists of attaching the force transducer to a simple, fixed-free beam and determining output as a function of base strain. Data obtained by use of this method are discussed and a mathematical model of the test beam's bending modes is presented. D.L.G.

N72-26821 Sandia Corp., Albuquerque, N.Mex.
THE MEASUREMENT OF MECHANICAL IMPEDANCE AND ITS USE IN VIBRATION TESTING
N. F. Hunter, Jr. and J. V. Otts *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 55-70 refs Sponsored by AEC (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Laboratory test procedures and instrumentation used to measure the impedance of structures are discussed. An interpretation of typical data and the utilization of this data are considered for the following: 1) derivation of laboratory test specifications; 2) comparison of a system's impedance characteristics before and after tests to determine structural failure; and 3) electronic simulation of a structure during force controlled vibration tests. Each of the applications is supported by specific examples. Author

N72-26822 Boeing Co., Seattle, Wash.

TRANSIENT TEST TECHNIQUES FOR MECHANICAL IMPEDANCE AND MODAL SURVEY TESTING

John D. Favour, Malcolm C. Mitchell, and Norman L. Olson *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 71-82 refs (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

This historical development of transient test techniques utilizing the modern digital computer to analyze transient data to define mechanical impedance and modal survey information is discussed. Complex frequency functions, such as apparent mass and transmissibility transfer functions, are developed through ratios of Fourier transforms and digitally plotted both in rectilinear (magnitude and phases vs. frequency) and polar (Nyquist) forms. Validation of early software (prior to the advent of fast Fourier transforms), through mechanical impedance measurements on the Bouche aluminum beam demonstrated dynamic range and frequency accuracy superior to existing analog techniques. The operating logic of present digital software routines is discussed. Attention is drawn to the digital plotting of transfer function data in the polar (Nyquist) form, and in particular, the advantages of the annotation method developed. Author

N72-26823*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

PREDICTION OF FORCE SPECTRA BY MECHANICAL IMPEDANCE AND ACOUSTIC MOBILITY MEASUREMENT TECHNIQUES

R. W. Shock and G. C. Kao (Wyle Labs., Inc., Huntsville, Ala.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 83-96 refs Prepared jointly by NASA. Marshall Space Flight Center and Wyle Labs., Inc., Huntsville, Ala. (See N72-26815 17-32)
(Contract NAS8-25811)
(NASA-TM-X-68470) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 20K

A method is described to calculate broad frequency range vibration criteria which account for both primary and component load impedance for structures subjected to random acoustic excitation. These criteria rather than being defined in traditional motion parameters are defined in force parameters and are, therefore, termed force spectra. The force spectra were predicted by a one-dimensional equation which utilizes four types of data measured at equipment mounting locations. These data consist of: input impedance of support structure, acoustic mobility of support structure, input impedance of component package, and blocked pressure spectrum. An experimental program was conducted to validate the prediction equation. A stiffened aluminum cylinder was used in acquiring input impedances and acoustic mobilities. An aluminum plate was used as a simulated component. All test data were acquired on-line to analog/digital acquisition systems. Good agreements between the predicted and measured force spectra were obtained. Author

N72-26824 Structural Dynamics Research Corp., Cincinnati, Ohio.

DYNAMIC DESIGN ANALYSIS VIA THE BUILDING BLOCK APPROACH

Albert L. Klosterman and Jason R. Lemon *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 97-104 (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A solution is considered to the problems involved in attempts to use experimentally measured impedance data to represent various components in a total system dynamic analysis. It is pointed out that in cases where the component under test is highly resonant and has multiple connection points, the direct use of this response data is unsatisfactory. Techniques are illustrated which can be used to obtain an analytical representation of the dynamic characteristics of a system from the response data. Mathematical formulations necessary to represent the equations of motion of the total system are described. The procedures are then applied to large complex mechanical machinery to perform a total system dynamic design analysis. D.L.G.

N72-26825 Imperial Coll. of Science and Technology, London (England).

MOBILITY MEASUREMENTS FOR THE VIBRATION ANALYSIS OF CONNECTED STRUCTURES

D. J. Ewins and M. G. Sainsbury *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 105-113 refs Sponsored by Min. of Defence (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Standard impedance testing methods are generally inadequate for measuring the required multidirectional mobility data, and the work described is an attempt to develop techniques for obtaining such data. Measurements were made on a freely supported beam and on a resiliently mounted block, and these data were used to predict the response of the system formed by bolting the beam and the block together. The results illustrate the importance of obtaining sufficiently complete and accurate data of mobility measurements are to be used for the vibration analysis of connected structures. Author

N72-26826 Naval Ship Research and Development Center, Annapolis, Md. Machinery Dynamics Div.

LIQUID-STRUCTURE COUPLING IN CURVED PIPES, 2

L. C. Davidson and D. R. Samsury *In* Shock and Vibration Inform. Center The Shock and Vibration Bull, No. 41, Pt. 1 Jan. 1972 p 123-136 refs (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The coupled vibrational characteristics of a pipe assembly comprised of straight sections and uniform bends arranged in a nonplane configuration were analyzed. The results indicate a significant level of coupling between the plane compressional wave in the contained liquid and beam responses of the pipe. Experiments confirm the general level of coupling but indicate some difficulty in predicting the fine detail of frequency response. Author

N72-26827 General American Transportation Corp., Niles, Ill.

A SURVEY OF THE TRANSPORTATION SHOCK AND VIBRATION INPUT TO CARGO

F. E. Ostrem *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 137-151 refs (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The shock and vibration environment encountered by cargo during transportation is reviewed. Available data describing the environment on trucks, railcars, ships and aircraft is summarized. The vibration environment is described in terms of probability of occurrence of peak accelerations (within selected frequency bands) as a function of frequency. Peak acceleration levels, 99.5%, 99%, 98%, and 90% probability levels are presented for particular vehicles covering a wide range of operating conditions. Curves are presented to show the effect of direction, load, location and speed on the environment. The shock environment is described in terms of shock spectra. Shock spectra are presented for typical events encountered during transportation, such as trucks crossing railroad tracks and backing into loading docks, railcars crossing railroad switches and railcar coupling events. Author

N72-26828 Sandia Labs., Albuquerque, N.Mex.

THE DYNAMIC ENVIRONMENT OF SELECTED MILITARY HELICOPTERS c02

Mark B. Gens *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 153-161 refs Supported by AEC (See N72-26815 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A study was conducted to determine the dynamic input to cargo from the floor of the cargo space in the OH-6, UH-1, CH-46, and CH-47 helicopters. The instrumentation, test procedures, data reduction processes, and results are discussed. The vibration regime for helicopters is shown to consist of a base of Gaussian random excitation with superimposed decaying sinusoids which are associated with rotor activity. Author

N72-26829 Army Transportation Engineering Agency, Newport News, Va.

HIGHWAY SHOCK INDEX

Robert Kennedy *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 163-167 (See N72-26815 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The Army, Navy, Air Force, and Marine Corps jointly sponsored and participated in the development of a shock index (SI) for highway transportation. A numerical SI, associated with a particular vehicle-load combination, can now be determined at a low cost by application of simple static field measurements. The SI provides classification for vehicle-load combination as regards probability of shocks transmitted to the cargo during highway shipments. Author

N72-26830 Naval Research Lab., Washington, D.C.

DEVELOPMENT OF A ROUGH ROAD SIMULATOR AND SPECIFICATION FOR TESTING OF EQUIPMENT TRANSPORTED IN WHEELED VEHICLES c14

Harold M. Forkois and Edward W. Clements *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 169-190 refs (See N72-26815 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A rough-road simulator machine was constructed and placed on successful operation. The simulator employs rotating drums with detachable road profiles, or bumps, which are interfaced with a wheeled vehicle to provide a random shock and vibration environment. This machine was the experimental device employed to simulate field conditions in the laboratory for the acquisition of shock and vibration data. The analysis of acceleration records of the response of the wheeled vehicle platform, both unloaded and with incremental loads, provided a description of the simulated environment, or what alternatively may be described as a calibration of the performance of the rough-road simulator machine. A proposed draft of a wheeled-vehicle rough-road transportation test specification is presented, which is related to the use of this machine. Author

N72-26831 Army Tank-Automotive Command, Warren, Mich.

LABORATORY CONTROL OF DYNAMIC VEHICLE TESTING

James W. Grant *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 191-196 refs (See N72-26815 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

In order to study vehicle suspension and frame dynamics under controlled and reproducible laboratory conditions, TACOM's road simulator or shaker test was developed. A road simulator is a laboratory test device which imparts dynamic forces simulating road inputs, on a complex vehicle. The results are presented of a study to develop vertical position control signals for the road simulator so that good correlation between laboratory test and field results is obtained. Three methods for acquiring the road simulator control signal are presented. Author

N72-26832 General American Transportation Corp., Niles, Ill. General American Research Div.

IMPACT VULNERABILITY OF TANK CAR HEADS

Jen C. Shang and John E. Everett *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 197-210 refs (See N72-26815 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

An impact vulnerability study of tank car heads was undertaken by means of semi-analytical evaluation of head failures through careful observation of indentations and punctures which were produced in a series of full-scale tests. The parameters which would influence the vulnerability of tank car heads were identified. Simple formulas which could be used to determine the permanent indentation and the impact force were developed in conjunction with a theoretical analysis of influential dimensionless parameters and an application of Hertz, force-indentation law to collision problems. Finally, the tank car head failure criteria were established. Author

N72-26833 Army Missile Command, Redstone Arsenal, Ala.

A STUDY OF IMPACT TEST EFFECTS UPON FOAMED PLASTIC CONTAINERS

Don McDaniel and Richard M. Wyskida (Ala. Univ., Huntsville) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 211-222 refs (See N72-26815 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Various types of foamed thermoplastic materials are utilized as cushioning systems in military containers. The primary aspects of cushioning design theory currently being utilized by container designers to predict the response of packaged items when subjected to free-fall drop tests are discussed. The test results of all readily available military container designs utilizing foamed plastic cushioning systems are analyzed to determine the statistical significance of the various factors affecting container response. The analysis of the factors involved is compared with cushioning theory. The superimposed dynamic cushioning curve technique is then presented as an improved method for presenting the cushioning properties of foamed plastic materials. Author

N72-26834 International Business Machines Corp., Rochester, Minn.

DEVELOPMENT OF A PRODUCT PROTECTION SYSTEM

Dennis E. Young and Stephen R. Pierce (Mich. State Univ., East Lansing) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 223-234 refs (See N72-26815 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A workable method for development of a product protection system, based on hardware and established procedure, is presented. The date and techniques used in product design determine the inherent strengths and fragilities of a product. These characteristics are determined by fragility assessment. Coincidentally, a continuing program statistically quantifies the non-use environment through which the product must pass. These data, along with knowledge of packaging methods and material characteristics, are combined to engineer the package. Once engineered, the package and product are tested by dynamic simulation of the non-use environment. The packaging program described indicates that the method maximizes the packaging engineer's chances of submitting the ideal economic and protective package the first time. Author

N72-26835 Naval Civil Engineering Lab., Port Hueneme, Calif.
MOTION OF FREELY SUSPENDED LOADS DUE TO HORIZONTAL SHIP MOTION IN RANDOM HEAD SEAS
H. S. Zwibel *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 1 Jan. 1972 p 235-245 refs (See N72-26815 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The theory is developed for the swinging motion induced in a wire suspended load due to the horizontal motion of a ship. An explicit formula is obtained for the significant amplitude of horizontal load motion when the ship is exposed to random head seas. Numerical results are presented for two typical cargo ships in a sea state three. It is found that very large motions are suffered by the load. For critical line lengths, resonance effects magnify the ship motion by several orders of magnitude. In addition, numerical solutions are also obtained for the pendulation due to simple harmonic motion of the support while the load is being raised or lowered. The peak displacements are considerably less in this case, however, they are still undesirably large. Author

N72-26836 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN, NO. 42. PART 2: GROUND MOTION, DYNAMIC ANALYSIS Conference Proceedings
Jan. 1972 257 p refs Presented at 42d Symp. on Shock and Vibration, Key West, Fla., 2-4 Nov. 1971 5 Vol.
(AD-739575; Bull-42-Pt-2) Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The proceedings of the Ground Motion Dynamic Analysis portion of the Shock and Vibration Symposium are presented. The subjects discussed during this session include: (1) vibration testing related to earthquake response spectra, (2) seismic evaluation of electrical equipment for nuclear power stations, (3) rocking of underwater structures subjected to seafloor seismic excitation, (4) reaction of tank bottom hull plates subjected to mine explosions, (5) circular cantilever beam elastic response to explosion, and (6) measurement of impulse from scaled buried explosives. For individual titles, see N72-26837 through N72-26859.

N72-26837 Westinghouse Research Labs., Pittsburgh, Pa.
SINE BEAT VIBRATION TESTING RELATED TO EARTHQUAKE RESPONSE SPECTRA c13
E. G. Fischer *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 1-9 refs (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Vibration test criteria are developed for evaluating the earthquake resistance and reliability of electrical switchgear, including sensitive control devices. A series of sine beat vibrations applied at experimentally determined, natural frequencies of the equipment is potentially more damaging than the original seismic motion. The test table input can be related to the floor response spectra as calculated for a particular power plant structure and location in an active earthquake zone. Author

N72-26838 Battelle Memorial Inst., Columbus, Ohio.
SEISMIC EVALUATION OF ELECTRICAL EQUIPMENT FOR NUCLEAR POWER STATIONS c14
Robert H. Prause and Donald R. Ahlbeck *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 11-20 refs (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A review of current seismic specifications for electrical equipment and the different types of vibration excitation that might be used to satisfy these specifications led to the design and construction of a seismic vibration facility with the capability of reproducing typical building floor earthquake acceleration time histories. The design of the vibration table and control system and the development of the acceleration time-history command signal are discussed. A comparison of the acceleration response spectra for the table motion and a typical command signal demonstrates the feasibility of using this type of realistic simulation of earthquake motions for evaluating electrical equipment performance. Significant results from this work are included to provide equipment designers with some typical experience. Author

N72-26839 California Univ., Livermore. Lawrence Livermore Lab.
SHOCK INPUT FOR EARTHQUAKE STUDIES USING GROUND MOTION FROM UNDERGROUND NUCLEAR EXPLOSIONS c13
D. L. Bernreuter, D. M. Norris, Jr., and F. J. Tokarz *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 21-31 refs Sponsored in part by AEC (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Comparisons are made between the ground motion from earthquakes (EQs) and underground nuclear explosions (UNEs). It is shown that peak g-levels and response spectra form a reasonable basis for comparison. Several approaches which attempt to characterize the time history are also discussed. It is shown that: (1) the peak g-levels from UNEs have magnitudes comparable to those estimated for the strongest EQs, (2) the spectra from UNEs are similar to those from EQs, and (3) a time history comparison shows that both the duration of strong motion and the number of near-peak g-level cycles for UNEs fall within the range established for strong EQs. Based on these results it is concluded that ground motion from UNEs can provide an EQ-like environment for testing full-scale structures. Author

N72-26840 Naval Civil Engineering Lab., Port Hueneme, Calif.
ROCKING OF A RIGID, UNDERWATER BOTTOM-FOUNDED STRUCTURE SUBJECTED TO SEISMIC SEAFLOOR EXCITATION
J. G. Hammer and H. S. Zwibel *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 33-44 refs (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

An analytical study of an early-generation seafloor structure subjected to severe seismic excitation is described. The structure is assumed to consist of a spherical pressure hull supported on legs, which in turn rest on pads on the sea floor. Friction between the pads and the underlying soil and the shear resistance of the soil prevent sliding of the structure, but the structure tends to rock rigidly in a manner that compresses the soil beneath it and may cause lifting off. The problem is formulated by second order differential equations containing non-linear terms. Effects of drag, added mass, and foundation reaction are considered. A numerical method of solution is followed that generates solutions at successive time intervals that are automatically adjusted to conform with preestablished accuracy criteria. An example structure is analyzed and its response computed for three different support conditions. The results are shown in terms of displacement and accelerations of the structure and shearing force and vertical reactions of the supporting medium. Author

N72-26841 Parsons (Ralph M.) Co., Los Angeles, Calif.
DEVELOPMENT OF A WAVEFORM SYNTHESIS TECHNIQUE: A SUPPLEMENT TO RESPONSE SPECTRUM AS A DEFINITION OF SHOCK ENVIRONMENT
Robert C. Yang and Herbert R. Saffell *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 45-53 ref (See N72-26836 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A procedure is developed for synthesizing a time-history to describe a transient disturbance such that the response spectrum of the disturbance matches a given spectrum and the amplitude ratios and phase relationships of its frequency components remain within assigned ranges. Author

N72-26842 Naval Civil Engineering Lab., Port Hueneme, Calif.

THE RESPONSE OF AN ISOLATED FLOOR SLAB: RESULTS OF AN EXPERIMENT IN EVENT DIAL PACK

J. M. Ferritto *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 55-65 ref (See N72-26836 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A test of a horizontal cylinder covered with an earth berm subjected to the pressure and drag forces in the 300 psi overpressure region from the detonation of a 500-ton high-explosive shot of Event DIAL PACK is outlined. The objective of this test was to obtain information on the response of an isolated floor slab placed on a soil fill inside the concrete cylinder. Data from seventeen channels of active instrumentation, composed of a pressure cell, velocity gages and accelerometers were recorded. Reduction of the data was made. Author

N72-26843 California Univ., Livermore. Lawrence Livermore Lab.

A SHOCK-ISOLATION SYSTEM FOR 22 FEET OF VERTICAL GROUND MOTION

E. C. Jackson, A. B. Miller, and D. L. Bernreuter *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 67-74 ref Sponsored in part by AEC (See N72-26836 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Shock isolation of fragile equipment from severe ground motion induced by underground nuclear detonations requires special techniques for inexpensive, reliable performance. Two shock-mitigation systems that have been used successfully for the past several years are described. These systems have allowed equipment to be located closer to the explosive source, resulting in considerable savings in diagnostic cable costs. A new system has been designed for even more severe ground motion. The new design, the instrumented testing program, and test results are discussed. Author

N72-26844 Mechanics Research, Inc., Los Angeles, Calif.

THE COMPARISON OF THE RESPONSE OF A HIGHWAY BRIDGE TO UNIFORM GROUND SHOCK AND MOVING GROUND EXCITATION

Neil E. Johnson and Robert D. Galletly *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 75-85 refs (See N72-26836 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

An analytical procedure is outlined for predicting the response of a highway bridge structure whose ground motion varies between its supports and is dependent upon seismic wave propagation characteristics. A typical six span highway bridge is presented. A finite element model of this bridge is developed including representation of soil/foundation stiffness and damping characteristics. The response of this structure is evaluated for the various ground motion conditions using normal mode techniques. The dynamic analysis of this structure was predicted using the MRI/STARDYNE Structural Analysis System. Author

N72-26845 Ballistic Research Labs., Aberdeen Proving Ground, Md. Vulnerability Lab.

DEFORMATION AND FRACTURE OF TANK BOTTOM HULL PLATES SUBJECTED TO MINE BLAST

Donald F. Haskell *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 87-96 ref (See N72-26836 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

An analytical study has been performed to develop a method for predicting the deformation and fracture characteristics of flat rectangular tank bottom hull plates subjected to blast attack from shallow buried mines located under the plate's center. The method of analysis is based on large structural plastic deformation, a semi-inverse energy method and a reasonable description of material behavior including a static stress-strain curve and strength failure criterion. Blast loading is characterized by the energy associated with the blast wave. Plate deformation is calculated by equating blast energy imparted to the plate to the strain energy absorbed by the plate in reaching its final deformed shape. These formulations developed correlate within an average error of 7% with available aluminum and steel plate mine blast test results. Author

N72-26846 Southwest Research Inst., San Antonio, Tex.

THE IMPULSE IMPARTED TO TARGETS BY THE DETONATION OF LAND MINES

Peter S. Westine *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 97-107 refs (See N72-26836 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A technique for predicting the impulse imparted to targets by explosions from land mines is discussed. The targets involved are the wheels and armor plate of military vehicles. It is shown that the impulse imparted to the target is not entirely the effect of air blast. The impulse is caused principally by the momentum of the soil particles surrounding the buried explosive. Several calculations are compared with experimental test results to establish the validity of the procedure. Author

N72-26847 Saskatchewan Univ., Saskatoon. Dept. of Mechanical Engineering.

CIRCULAR CANTILEVER BEAM ELASTIC RESPONSE TO AN EXPLOSION

Y. S. Kim and P. R. Ukrainetz *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 109-121 refs (See N72-26836 17-32)
(Grants DFB G-1678-09; NRC A-3384)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The response of a circular cantilever beam subjected to a plane transverse air blast was obtained. From this response, the drag coefficients of the circular cylinder under the unsteady flow conditions of an air blast wave were determined using the domain conversion method. Using this method, a conversion of the response was made from the time domain into the frequency domain and then from the frequency domain back to the time domain. Two circular aluminum cantilever beams of lengths 5 ft and 2 1/2 ft, and diameters 3 in. and 2 in., respectively, were tested at the 11 psi nominal overpressure location in a 500 ton TNT field explosion (Dial Pack). From the measured response, the drag force was obtained, and using the empirical equation for dynamic pressure, the drag coefficients were obtained. Author

N72-26848 Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

MEASUREMENT OF IMPULSE FROM SCALED BURIED EXPLOSIVES

Bruce L. Morris *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 123-127 refs (See N72-26836 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A dimensional analysis was performed to determine the physical scaling parameters governing the response of wheels to blast loading. Hopkinson scaling was used to determine the proper charge size and location for one-quarter scale blast tests. The total energy imported to the test wheels by the detonation was determined, and the scaled specific impulse was calculated. The test and calculation procedures are described. Author

N72-26849*# Martin Marietta Corp., Denver, Colo.

THE EFFECTS OF MOMENTUM WHEELS ON THE FREQUENCY RESPONSE CHARACTERISTICS OF LARGE FLEXIBLE STRUCTURES

F. D. Day, III and S. R. Tomer *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 129-136 refs (See N72-26836 17-32)
(Contract NAS8-24000)
(NASA-CR-127074) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 20K

A computer program using existing mathematical techniques has been developed for use in performing linear frequency response analyses of large elastic systems that contain axisymmetric momentum wheels (gyros). The program incorporates the state vector form of the dynamic equations of motion, and uses complex eigenvalue/eigenvector transformations to yield a set of uncoupled equations that are easily solved for the steady-state responses of the system. The structural characteristics are input in the form of normal modes of the system with nonrotating momentum wheels. These system modes may be derived directly from a finite-element model or through the modal coupling of a number of subsystems. The program was used to calculate transfer functions on the Skylab Apollo telescope mount both with and without the control moment gyros. A comparison of these transfer functions is presented. Author

N72-26850*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

INTEGRATED DYNAMIC ANALYSIS OF A SPACE STATION WITH CONTROLLABLE SOLAR ARRAYS

Joseph A. Heinrichs (Fairchild Ind., Inc., Germantown, Md.), Alan L. Weinberger (Fairchild Ind., Inc., Germantown, Md.), and Marvin D. Rhodes *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 137-152 refs (See N72-26836 17-32)
(NASA-TM-X-68469) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 20K

An integrated dynamic analysis and corresponding digital computer simulation for application to a space station with controllable solar arrays are presented. The analysis and simulation have been developed for the primary purpose of evaluating dynamic load interactions between the solar arrays and the space station which can result from orbital perturbations of the combined system. Integrated into the analytical formulation are the dynamics associated with the space station, the solar array flexibilities and their respective control systems. Application of the simulation is made utilizing present concepts of a space station with large area arrays and of typical control systems. A structural analysis of the flexible solar arrays is initially required to provide modal data for the simulation; and analytical results for an array concept are given. A verification of the structural dynamic methods used in the simulation is presented. This verification is accomplished by the application of the simulation to a problem of known solution, a uniform beam subjected to a unit step load applied at mid-span. Author

N72-26851 International Business Machines Corp., East Fishkill, N.Y.

PARAMETRICALLY EXCITED COLUMN WITH HYSTERETIC MATERIAL PROPERTIES

D. T. Mozer and R. M. Evan-Iwanowski (Syracuse Univ., N. Y.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 153-161 refs (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

An investigation is performed to determine the effects of hysteretic material properties on the dynamic response of parametrically excited systems. Expressions are developed for stress distributions, forces and moments for a parametrically excited column. Column response is determined for the stationary case with additional assumptions on material properties and stress distributions. Author

N72-26852 Louisville Univ., Ky. Dept. of Civil Engineering.

DYNAMIC INTERACTION BETWEEN VIBRATING CONVEYORS AND SUPPORTING STRUCTURE

Mario Paz and Oscar Mathis (Rex Chainbelt, Inc., Louisville, Ky.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 163-169 refs (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The dynamic analysis of the conveyor-structure system is presented using the stiffness method and an iterative scheme in which the structure and the vibrating conveyor are analyzed successively taking into account interacting effects. An example of a structural truss supporting a vibrating conveyor is given. Author

N72-26853 North Eastern Research Associates, Upper Montclair, N.J.

RESPONSE OF A SIMPLY SUPPORTED CIRCULAR PLATE EXPOSED TO THERMAL AND PRESSURE LOADING

J. E. Koch and M. L. Cohen *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 171-180 refs (See N72-26836 17-32)
(Contracts N00140-70-C-0019; N60921-71-C-0197)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Using classical plate theory, equations are derived for the response of a simply supported circular plate exposed to time dependent pressure and thermal loading. Results based on these equations are presented for several loading conditions and plate geometries. One interesting effect is the presence of thermally induced vibrations having rather substantial amplitude in some cases. In addition it was observed that the thermal stresses may be compressive at both the front and rear surfaces, and tensile in the center. Author

N72-26854 Naval Ship Research and Development Center, Washington, D.C.

WHIRL FLUTTER ANALYSIS OF PROPELLER-NACELLE-PYLON SYSTEM ON LARGE SURFACE EFFECT VEHICLES

Yuan-Ning Liu *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 181-194 refs (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A typical propeller-nacelle-pylon configuration installed on large surface effect vehicles is analyzed for dynamic stability in normal operations. A whirl-flutter theory developed by the aircraft industry for propeller-rotor dynamics is used to establish stability boundaries for variations of physical parameters of a propeller-nacelle-pylon system. The stability boundaries are presented in chart forms which can be used as design guides. The uppermost and lowest bounds for stability are shown on these charts. Classical whirl-flutter theory, which considers ideally rigid blades, defines the most conservative design and the uppermost bound. Observations on the investigation of nacelle vibration on existing hovercrafts indicates that whirl-flutter could properly explain the results. Author

N72-26855 Battelle Memorial Inst., Columbus, Ohio.

THE DYNAMIC RESPONSE OF STRUCTURES SUBJECTED TO TIME-DEPENDENT BOUNDARY CONDITIONS USING THE FINITE ELEMENT METHOD

George A. Workman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 195-201 refs (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The dynamic-matrix equation of motion characteristic of structures modeled by the finite element method of analysis is written in general form. This matrix equation is then rearranged and partitioned to separate constrained and unconstrained displacement degrees of freedom. Once the general matrix equation has been properly partitioned, then by standard matrix manipulations, the original mixed boundary value problem is transformed to a modified force motion problem. The dynamic response of a bellows subjected to dynamic edge displacements and internal pressure, as determined by this approach, is presented. This example is used as a vehicle to demonstrate the versatility and effectiveness of this solution technique. Author

N72-26856 General Electric Co., Philadelphia, Pa. Space Div.
VIBRATION ANALYSIS AND TEST OF THE EARTH RESOURCES TECHNOLOGY SATELLITE
T. J. Cokonis and G. Sardella *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 203-211 refs (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A unique approach used for the launch vibration analysis of the Earth Resources Technology Satellite (ERTS) is presented. The ERTS is basically a modification of the Nimbus vehicle with solar array paddles unchanged. The complex paddle system could best be represented by measured data obtained from previous Nimbus modal testing. The successful extraction and subsequent recoupling on ERTS of the solar array paddle modes from the original Nimbus experimental mode shapes is given. The analytical model is described along with its verification by an abbreviated modal test. Good correlation between test and analysis was evidenced by frequency and mode shape comparisons. Some areas of discrepancy in the analytical model were uncovered which were subsequently modified to improve the analytical representation of the spacecraft. Author

N72-26857 Johns Hopkins Univ., Baltimore, Md.
FINITE AMPLITUDE SHOCK WAVES IN INTERVERTEBRAL DISCS c04
William F. Hartman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 213-219 refs (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The nonlinear deformation of intervertebral discs is discussed. The upward turning stress-strain curve implies that the discs will tend to shape pulses having sub-millisecond rise-times into shock waves and that shock inputs will propagate as shocks. These implications are explored for axial compressive impact of the spine, such as is incurred during aircraft-pilot ejection or during a fall onto the buttocks. Correlation with experimental results suggests that the application of finite amplitude wave theory to the shock loading of the spine should be investigated. Author

N72-26858 Bell Telephone Labs., Inc., Whippany, N.J.
ACCELERATION RESPONSE OF A BLAST-LOADED PLATE
Lawrence W. Fagel *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 221-233 refs (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A solution for a simply supported plate loaded by a step-function pressure is closely examined to determine contributions to acceleration from the plate's higher modes of vibration. Plate dimensions are assumed to be such that classical bending equations apply, and it is established that the peak acceleration response can be as much as 2.6 times the peak response of a one-degree-of-freedom analog. When damping is incorporated in the solution, the peak values are attenuated and much of the very-high-frequency response appears to dissipate rapidly. In practical situations where the damping ratio will be at least 1 percent, nine modes should adequately represent the plate's true response; however, computed accelerations may be nonconservative by up to 40 percent if only four modes are considered and by more than 100 percent if only one mode is used. Author

N72-26859 Advanced Technology Center, Inc., Dallas, Tex.
EFFECT OF CORRELATION IN HIGH-INTENSITY NOISE TESTING AS INDICATED BY THE RESPONSE OF AN INFINITE STRIP
Charles T. Morrow *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 2 Jan. 1972 p 235-245 (See N72-26836 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A narrow strip (bar or ribbon) is taken as a theoretical test case for the realism of high-intensity noise testing in much the same way that a simple mechanical resonator is commonly taken as a theoretical test case for more conventional shock and vibration testing. It is shown that in an effort to design a realistic test, one must consider the point-to-point correlation of the applied field as well as the sound pressure level, even when the damping of the strip is large enough to prevent significant return reflections from the ends. The types of correlation investigated in particular are the complete correlation at the coincidence angle for the given frequency, and independent excitations at the different antinodal regions. With minor reinterpretation, the formulas remain applicable when, in addition, an exponential decay of correlation with distance in either direction along the strip is introduced. Author

N72-26860 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN, NO. 42. PART 3: TEST CONTROL, FACILITIES, TECHNIQUES Conference Proceedings
Jan. 1972 228 p refs Presented at 42d Symp. on Shock and Vibration, Key West, Fla., 2-4 Nov. 1971 5 Vol.
(AD-739576; Bull-42-Pt-3) Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The papers presented to the symposium on shock and vibrations concerning test control, test facilities, and techniques are reported. For individual titles, see N72-26861 through N72-26881.

N72-26861 Hughes Aircraft Co., Culver City, Calif.
ON THE PERFORMANCE OF TDM AVERAGERS IN RANDOM VIBRATION TESTS
Allen J. Curtis *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 1-13 refs (See N72-26860 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Four factors which influence the performance of the Time-Division-Multiplexer (TDM) are discussed. The first is the relative phase or polarity of the several inputs to the TDM. The last three, which are very interdependent, are: the relative magnitudes of the several input spectral densities within any control or analysis bandwidth; the type of detection employed to measure the spectral density; the response time and bandwidth of the filters used to analyze the TDM output signal. It is shown that polarity changes can cause significant (> 5 db) over and/or under test due to spectral spreading of peaks and notches. The use of average detection during processing of the TDM signal is analyzed and may often contribute an overtest of at least 3 db. However, compensating errors due to response time of typical filters will tend to counterbalance this error. The virtual elimination of these errors with the use of mean square detection is demonstrated. The performance of the TDM during a number of laboratory tests has been analyzed and is shown to be generally satisfactory. Methods to optimize test accuracy during TDM usage are delineated. Author

N72-26862 Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

A MULTIPLE DRIVER ADMITTANCE TECHNIQUE FOR VIBRATION TESTING OF COMPLEX STRUCTURES

Strether Smith and A. A. Woods, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 15-23 refs (See N72-26860 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A technique is presented for conducting and analyzing multiple shaker sine sweep tests to determine the modes of a structure. The approach greatly reduces the cost of performing a modal test program and improves the accuracy of the modal parameters measured. Author

N72-26863*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

EQUIPMENT CONSIDERATIONS FOR ULTRA LOW FREQUENCY MODAL TESTS c11

R. G. Shoulberg and R. H. Tuft *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 25-37 refs Prepared for JPL (See N72-26860 17-32)
(Contract JPL-952314)
(NASA-CR-127004) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 14B

A vibration system was developed for determining dynamic characteristics of flexible light weight structures with inherently low frequency vibration modes, and low internal damping relative to windage effects. System elements developed and integrated were: (1) dc coupled, high displacement vacuum rated electrodynamic vibration exciter; (2) low frequency sweep oscillator range .008 Hz to 10k Hz, sweep rates 0.00006 to 6 decades/min., linear, logarithmic and hyperbolic; (3) noncontacting, vacuum rated vibration sensors; (4) signal analyzer for determining coincident/quadrature amplitude relation between forcing and response parameters; and (5) servo control for maintaining constant forcing function. These elements were integrated and applied during extensive dynamic testing of a large roll-up solar array at absolute pressures of approximately 1 Torr. Author

N72-26864 Boeing Co., Seattle, Wash. Aerospace Group.

COMBINED-AXIS VIBRATION TESTING OF THE SRAM MISSILE

W. D. Trotter and D. V. Muth *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 39-48 ref (See N72-26860 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The requirement of the Short Range Attack Missile assembly vibration test, as part of a test series including structural static and fatigue load tests and a sonic fatigue test, was to demonstrate system operability during a simulated free flight mission after long-duration exposure to ground operation and captive flight environments. Flight test data showed that vibration levels were low and that conventional black box test procedures would be inappropriate. The technique described represents a departure from conventional test methods and is particularly well suited to the unique requirements of relatively large air launch missiles. Author

N72-26865 Naval Missile Center, Point Mugu, Calif.

SHOCK TESTING UTILIZING A TIME SHARING DIGITAL COMPUTER

Robert W. Canon *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 49-59 (See N72-26860 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

To demonstrate the feasibility of a total experiment being conducted with a timesharing digital computer, a testing arrangement was designed to use a local digital interface processor (the LP-1010) to run a drop-type shock testing machine in the Naval Missile Center's Environmental Laboratory. The system encompasses the complete test routine of process control, data acquisition, and immediate scientific analysis and results. The main advantages that have been demonstrated by use of a timesharing computer in the Environment Branch are: (1) convenient and easy access; (2) fast results, in a matter of seconds and minutes rather than hours or days; and (3) less expense, since charges are only for the time the computer is used; thus there is no investment in and maintenance of capital equipment. Author

N72-26866*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A TECHNIQUE FOR CLOSED-LOOP COMPUTER-CONTROLLED REVERSED-BENDING FATIGUE TESTS OF ACOUSTIC TREATMENT MATERIAL

Carl E. Rucker and Robert E. Grandle *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 61-68 refs (See N72-26860 17-32)
(NASA-TM-X-68466) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 20K

A description is given of a computer-controlled fatigue testing system which operated continuously without operator attention during testing. This system was designed to run a reversed-bending fatigue test on flight-weight porous fiber metals to develop fatigue data for this material. Tensile coupons were tested to determine the material properties, and the method of determining these properties is discussed. Fatigue data from one set of fiber-metal tests are also included. Author

N72-26867 MTS Systems Corp., Minneapolis, Minn.

PROGRAMMING AND CONTROL OF LARGE VIBRATION TABLES IN UNIAXIAL AND BIAXIAL MOTIONS

R. L. Larson *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 69-77 (See N72-26860 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The programming and control of large vibration tables and uniaxial or biaxial motions has long been a problem. Recent developments in servohydraulic analog control technique and digital programming and control methods have made such large systems very practical for performing seismic shock (earthquake) and transportation vibration tests. The topics include the servohydraulic control problems associated with large table systems and some of the programming techniques that are currently available. A large servohydraulically controlled biaxial shock test machine will be discussed to illustrate how the specific problems and requirements are translated into hardware and software to insure an efficient operation of the test facility. Author

N72-26868 Hughes Aircraft Co., Culver City, Calif.

A DATA AMPLIFIER GAIN-CODE RECORDING SYSTEM

J. R. Olbert and T. H. Hammond *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 79-82 (See N72-26860 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

To eliminate the need of an instrumentation operator manually logging amplifier gain settings, a system was designed which would continuously record all amplifier gain information on the same magnetic tape as the actual vibration data. This gain information is multiplexed with an IRIG-B time code signal and recorded on a single tape track. To accomplish this task, both time and frequency multiplexing schemes are used. Gain code output signals (dc voltage levels representing gain switch position) from data amplifiers are commutated, or time multiplexed, to provide a single output signal containing switch position information for 72 data amplifiers. This signal is then frequency multiplexed with the 1 KC IRIG-B time code. The composite signal, containing both amplifier gain information and time-of-day information is then available to record on a single tape track.

Author

N72-26869 Comsat Labs., Clarksburg, Md.

STABILITY OF AN AUTOMATIC NOTCH CONTROL SYSTEM IN SPACECRAFT TESTING

B. N. Agrawal *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 83-88 refs (See N72-26860 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

An automatic notch control system is simulated analytically. The response of the structure is obtained by numerical integration and, at each step of integration, the amplitude of base excitation is modified by the control equation. Such a simulation can be used to predict the stability of the notch control system and to adjust the compression ratio to its optimum value for the sinusoidal vibration testing.

Author

N72-26870 Lockheed Missiles and Space Co., Sunnyvale, Calif.

SINUSOIDAL VIBRATION OF POSEIDON SOLID PROPELLANT MOTORS

Lane R. Pendleton *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 89-98 refs (See N72-26860 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The Poseidon first and second stage solid propellant motors generate sinusoidal vibrations which result from acoustic pressure oscillations within the motor chambers. These pressure oscillations are caused by combustion instability and, to a lesser degree, by gas flow turbulence. This paper follows the investigation to determine the cause of these oscillations and describes the effects on missile structure and packages. Acceleration levels measured on the motor domes and on missile packages are presented. It was established through testing and analysis that all missile components could withstand the measured vibration levels with adequate margin. Motor vibration levels will be monitored on future ground tests to ensure that the existing acceptable vibration levels are not exceeded.

Author

N72-26871 Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.

CONFIDENCE IN PRODUCTION UNITS BASED ON QUALIFICATION VIBRATION

Ralph E. Deitrick *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 99-110 refs (See N72-26860 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Equations are presented for the variation in vibration exposure time as a function of input level for equivalent fatigue damage. The derivation uses Miner's Rule accounting for variation in structural damping and incorporates the effect of test tolerances. Considering the statistical characteristics of fatigue failure, the relationship between qualification unit and production unit failure probability is used to define qualification test duration requirements for assuring low failure probability of production units. An illustration of the application of the procedure is provided and the effect of acceptance/qualification test ratio is illustrated. The Aerospace Industry practice of occasionally using qualification units on the first flight spacecraft is discussed.

Author

N72-26872 Army Weapons Command, Rock Island, Ill. Weapons Lab.

SIMULATION TECHNIQUES IN DEVELOPMENT TESTING

Alexander Hammer *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 111-124 (See N72-26860 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The need for and the advantages of utilizing simulation technology when armament systems are applied to mobility devices such as armored vehicles, tanks and helicopters are discussed and the various approaches to the solution of the problems emanating from weapon-mount relationship observed during development testing are described. Also presented are the design features of a variable flexibility mount and associated equipment located at the Keith L. Ware Simulation and Experimental Firing Center, U. S. Army Weapons Command, which offer a mechanical solution to these problems, together with the description of the data acquisition, reduction and analysis equipment which control the simulator during actual weapon test firings, provide a limited amount of real-time processing, and assure automatic reduction of high frequency data acquired during the test.

Author

N72-26873 Radiation, Inc., Melbourne, Fla.

A ROTATIONAL SHOCK AND VIBRATION FACILITY c11

R. T. Fandrich, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 125-130 (See N72-26860 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The design and operation of a rotational shock and vibration facility are described. The requirement for this facility developed from design problems which emerged from special antenna designs. It is established that, in general, the rotational environment cannot be simulated by the linear environment and generates the rules which describe the difference. These rules can establish if a linear approximation is sufficient or if rotational considerations must be made. The application of these rules to the specific design problem establish the requirement for rotational testing. The systems' performance is evaluated both theoretically and empirically from results of actual rotational tests and rates the systems in terms similar to linear systems.

Author

N72-26874*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE EFFECTS OF VARIOUS PARAMETERS ON SPACECRAFT SEPARATION SHOCK c31

W. Brian Keegan and William F. Bangs *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 131-148 ref (See N72-26860 17-32) (NASA-TM-X-68467) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 22B

The results are presented of a series of 17 pyrotechnically actuated spacecraft separation tests conducted at the Goddard Space Flight Center. The prime objective was to evaluate the effects of varying the parameters which might possibly influence the magnitudes of the induced transient responses. Parametric variations investigated included: Marmon clamp tension (50% to 150% of flight tension), attach fitting end condition (fixed or free), simulation of burned-out third stage (static with several weights, dynamic and none), number of squibs fired (one or two), and separation springs (with and without). Two test firings were made for most of the conditions investigated, so as to measure the variation in levels induced by identical tests.

Author

N72-26875 TRW Systems Group, Redondo Beach, Calif.

NONDESTRUCTIVE TESTING OF WEAPONS EFFECTS ON COMBAT AND LOGISTICAL VEHICLES

R. L. Johnson, J. H. Leete, J. D. OKeefe, and A. N. Tedesco

(ARPA) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 149-157 (See N72-26860 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

An account is given of tests carried out to demonstrate the validity of a possible approach to simulating weapon secondary effects nondestructively. Secondary effects refer to weapon induced shock and vibration, but excludes plastic deformation, penetration by shrapnel, etc. The technique employed is that of a sacrificial plate wherein sacrificial armor attached to combat vehicles is used to absorb the plastic deformation of a projectile at the same time permitting the application of the elastic secondary load to the vehicle structure. The first tests were carried out at TRW using small scale armor and 22 calibre projectiles. The second series was carried out by DOD personnel at the Aberdeen Proving Grounds using 20 mm and 57 mm projectiles impacting thick armor plate attached to a M60ATET turret. The results of both experiments indicate that the far field response due to direct impact on the vehicle armor can be reproduced by impact on the sacrificial plate. Author

N72-26876 Honeywell, Inc., Hopkins, Minn. Government and Aeronautical Products Div.
THE EFFECT OF THE FIN-OPENING SHOCK ENVIRONMENT ON GUIDED MODULAR DISPENSER WEAPONS c34
K. D. Denton and K. A. Herzing *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 159-165 refs (See N72-26860 17-30)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Recent laboratory studies of a first-generation aircraft modular dispenser weapon have shown that modularity, while increasing the efficiency and effectiveness of the inventory, may result in subjecting weapon components to significant self-generated system operational environments for which the component was not originally designed or was not expected to experience in its normal manufacture-to-target logistic flow. For example, the shock environment produced by tailfin opening of a weapon in free flight was found to be a significant factor that should be considered when designing and developing future modular weapon systems employing folded fins. The results of the fin-opening shock study are presented and the fin-opening shock environment levels are shown to be higher than those allowed by conventional MIL-STD requirements. A procedure for developing a shock spectrum test criterion for modular fuze and guidance electronic components is also included. Author

N72-26877 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DEVELOPMENT OF A FLUIDIC HIGH-INTENSITY SOUND GENERATOR c23
Howard F. Wolfe *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 167-178 refs (See N72-26860 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

An experimental investigation was conducted to determine the performance characteristics of a prototype fluidic high intensity sound generator. Acoustic and steady-state flow tests of a two stage annular slot configuration were performed to establish the primary performance parameters. The acoustic performance for a sine sweep input indicated a relatively flat output between 600 and 1800 Hz. The steady-state results indicated that the load on the receiver altered considerably the nozzle pressure profiles and amplifier characteristics. A method of evaluating changes in geometry from steady-state measurements is presented. The configuration tested indicated that a greater modulation of the supply nozzle jet is needed to improve the performance. The possibility of modulating the sound output to almost any arbitrary input waveform without the limitations imposed by mechanical parts represents a significant advantage in high intensity sound generation. Author

N72-26878 Kaman Sciences Corp., Colorado Springs, Colo.
DEVELOPMENT OF A LIGHTWEIGHT, LINEAR MECHANICAL SPRING ELEMENT c15
R. E. Keeffe *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 179-185 refs (See N72-26860 17-32)
(Contract DAAH01-69-C-1809)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C., HC $4.00 per set

The analytic and experimental development of an annular plate spring element suitable for pulse shaping studies is presented. This element has the desirable characteristics of linearity and low-weight combined with the capability for obtaining the wide range spring rates necessary for transient shock pulse shaping experiments. Author

N72-26879 McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
TECHNIQUES FOR IMPULSE AND SHOCK TUBE TESTING OF SIMULATED REENTRY VEHICLES
N. K. Jamison *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 187-203 refs Sponsored by DASA (See N72-26860 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The test techniques and procedures used in instrumenting and testing 12 simulated reentry vehicles to impulse and blast loadings are described. These tests were designed to supply data for structural hardening analyses, but were not designed to simulate any specific nuclear effects loading. The vehicles were of the same gross weight, but contained different heat shield and substructure materials. The vehicles were subjected to both short duration impulse tests using contact sheet explosive and long duration blast tests using an explosively driven shock tube. The overall objectives of this dynamic structural response test program were to determine experimentally the structural behavior and failure of each vehicle, rank the vehicle configurations as to their capability in resisting dynamic loading, and obtain strain data at selected locations for correlation with and verification of structural response computer codes. To meet the objectives, test techniques were developed for instrumenting, supporting, and retrieving, and loading the vehicles in a manner that would simulate, as nearly as possible, free flight environmental conditions and that would obtain high quality strain data in a dynamic test environment. Author

N72-26880*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
VIBRATION FIXTURING: NEW CELLULAR DESIGN, SATURN AND ORBITAL WORKSHOP PROGRAMS c31
Russell L. Stafford *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jul. 1972 p 205-208 refs Sponsored by NASA (See N72-26860 17-32)
(NASA-CR-127084) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 22B

During the test programs for the Saturn S4B/5, 1B, and Orbital Workshop, most of the vibration items were tested by mounting them on sections of vehicle structure representing actual vehicle installation. Some vehicle sections were as large as 5-1/2 by 10 ft. Fixtures, for mounting and holding these structures during vibration, having the capability of transmitting vibration up to 2,000 Hz to the extreme edges of the structure and, subsequently, to the test items, presented special design problems. Most large vibration fixtures used for these programs were of welded tubular construction. The welded tubular concept proved successful, complex, heavy, and costly. Therefore, a new cellular structure fixture design concept was used for some items of the Orbital Workshop. The cellular structure concept discussed has a higher stiffness-to-weight ratio and is less costly than previous tubular designs. Author

N72-26881 California State Coll., Long Beach.

WALL FLOW NOISE IN A SUBSONIC DIFFUSER c12

E. F. Timpke and R. C. Binder (Univ. of Southern Calif., Los Angeles) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 209-216 refs Prepared in cooperation with Univ. of Southern Calif. (See N72-26860 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The results are presented of an experimental investigation of wall flow noise in a variable-angle two-dimensional subsonic diffuser. Measurements were made of the sound pressure level, power spectral density, and the cross-correlation function. Wall noise measurements were made at various locations in the diffuser for flow through a parallel wall channel, flow approaching separation, and separated flow. The sound pressure level increased as the diffuser angle increased, and reached a maximum at flow separation. The sound pressure level was as much as 28 decibels higher at the separation point as compared to the sound pressure level for flow between parallel walls. The magnitude of the root-mean-square wall pressure fluctuations in turbulent flow was 0.0053 times the free stream dynamic pressure. The convection velocity was 0.83 times the free stream velocity for flow in parallel walls and decreased to 0.73 times the free stream velocity beyond separation. An analytical distribution function was developed to describe the spectral noise characteristics of the large scale turbulent eddies as the flow field changed. Author

N72-26882 Shock and Vibration Information Center (Defense), Washington, D.C.

THE SHOCK AND VIBRATION BULLETIN, NO. 42. PART 4: ISOLATION, DAMPING, PREDICTION EXPERIMENTAL TECHNIQUES Conference Proceedings

Jan. 1972 263 p refs Presented at the 42d Symp. on Shock and Vibration, Key West, Fla., 2-4 Nov. 1971 5 Vol.

(AD-739577; Bull-42-Pt-4) Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Data on the effects of forced and free vibration on various structures are summarized. Detailed information is provided for predicting structural response to vibration, finding materials for controlling vibration, and designing equipment for reduction and control of vibration. For individual titles, see N72-26883 through N72-26903.

N72-26883 Minnesota Univ., Minneapolis.

TRANSIENT RESPONSE OF REAL DISSIPATIVE STRUCTURES

R. Plunkett *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 1-5 refs (See N72-26882 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The physics of transient shock response in real structures and methods for predicting that response are outlined. E.H.W.

N72-26884 IIT Research Inst., Chicago, Ill.

DYNAMIC RESPONSE OF A RING SPRING

Ronald L. Eshleman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 7-14 refs (See N72-26882 17-32)

(Contract F04694-67-C-0076)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The dynamic response of a ring spring to high rate loading was studied analytically and experimentally with special emphasis on high frequency effects. Explicit analytical expressions for ring spring force-deflection curves with separate stiffness and damping terms were formed. The mathematical model which represents the spring mass elasticity and damping is a form of the classical wave equation. This model was used in conjunction with a massive rigid body to study its shock isolation characteristics analytically and experimentally. Tests were conducted on one and one-half inch diameter springs in an MTS closed loop electrohydraulic shock isolation test machine. Author

N72-26885 Admiralty Surface Weapons Establishment, Portsmouth (England).

SHOCK MOUNTING SYSTEM FOR ELECTRONIC CABINETS c15

W. D. Delany *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 15-20 (See N72-26882 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

An experimental shock mounting system, designed for use in electronic cabinets onboard naval ships, is described. The system is designed to withstand repeated deflection due to shock or vibration, perform well under various temperature changes, and be able to maintain performance in limited space. Shock, vibration, and endurance test results show the system has a vertical natural frequency of 6 Hz, damping 0.15 critical, and relative displacement of + or - 2 1/2 inches. Author

N72-26886 Martin Marietta Corp., Denver, Colo.

METHODS OF ATTENUATING PYROTECHNIC SHOCK

S. Barrett and W. J. Kacena *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 21-32 refs (See N72-26882 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $4.00 per set

A series of tests were performed on pyrotechnic devices in an effort to reduce shock effects. Various materials were used as shock isolators both at component mounting locations and at mechanically fastened structural joints. The test results are given along with a comparison of the effects of various isolation configurations on a shock response spectrum basis. Author

N72-26887 Argonne National Lab., Ill.

ENERGY ABSORPTION CAPACITY OF A SANDWICH PLATE WITH CRUSHABLE CORE

D. Krajcinovic *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 33-40 refs Sponsored in part by AEC (See N72-26882 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A simple, approximate dynamic analysis of a sandwich type pressure vessel head plate with a significant energy absorbing potential is presented. The analysis is based on the propagation of a compression (shock) front through the core made of crushable material. Author

N72-26888 Naval Ship Research and Development Center, Bethesda, Md.

ON THE DAMPING OF TRANSVERSE MOTION OF FREE-FREE BEAMS IN DENSE, STAGNANT FLUIDS

William K. Blake *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 41-56 refs (See N72-26882 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The damping of free-free beams vibrating in dense, still fluids was studied experimentally. Viscous dissipation was examined in mixtures of glycerine and water using a series of beams with different geometries, thus the independent effects of varying fluid viscosity, beam thickness, and frequency of vibration, were established. Damping was determined by measuring 60 dB decay times at resonant frequencies following an impact. In a parallel series of experiments, acoustic radiated power was measured in a water filled reverberant chamber. Both the densities and the geometries of the beams were varied in order to establish the effects of dense fluid loading. Results are reported as ratios of radiated power to mean square beam velocity and these ratios are compared with theoretical estimates.

The radiation, modeled as finite line of dipoles, is seen to be determined by the motion of the beam near the tips. The results raise considerable question concerning the validity of measuring the damping characteristics of material samples in water. It appears that the shapes of material samples on which damping measurements are to be made must be designed to minimize spurious fluid damping effects, otherwise the results may be more particular to the experiment configuration than to the material itself. Author

N72-26889*# Minnesota Univ., Minneapolis.
OPTIMUM DAMPING DISTRIBUTION FOR STRUCTURAL VIBRATION
R. Plunkett *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 57-64 refs (See N72-26882 17-32)
(Grant NGR-24-005-095)
(NASA-CR-127005) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 20K

The optimum distribution and amount of damping treatment for controlling the vibration response of a uniform beam in bending with various end restraints was investigated. For reasonable parameters it is found that optimal distribution is highly peaked at the center, but that a uniform distribution of the same weight of damping treatment will increase the response by only a few percent. It is also found that optimum damping for theroetical minimum response is practically unobtainable so that almost any increase in the amount of damping treatment will reduce the vibration level. The question then changes from one of structural optimization regardless of cost to one of cost-effectiveness. Author

N72-26890*# General Electric Co., Philadelphia, Pa. Space Div.
A LAYERED VISCOELASTIC EPOXY RIGID FOAM MATERIAL FOR VIBRATION CONTROL c18
C. V. Stahle and A. T. Tweedie *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 65-75 ref (See N72-26882 17-32)
(Contract NAS5-11320)
(NASA-CR-127027) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 11D

Experimental results are presented for cantilever beam element tests used to determine the damping characteristics of selected space compatible materials and evaluate layered and laminated configurations. The use of the layered material for a relay panel installation in the NASA-Goddard Space Flight Center Earth Resources Technology Satellite Power Switching Module is described and vibration test results are presented. Author

N72-26891 Minnesota Univ., Minneapolis.
OPTIMIZATION OF A COMBINED RUZICKA AND SNOWDON VIBRATION ISOLATION SYSTEM
Dennis E. Zeidler (Medtronic, Inc.) and Darrell Frohrib *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 77-83 refs (See N72-26882 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

An isolator combining the advantages of optimized Ruzicka and Snowdon models is presented. This isolator is demonstrated to have superior performance properties as evaluated by a criterion function of the form I sub t = DT sub p + log T sub h. Author

N72-26892 Barry Wright Corp., Burbank, Calif.
TRANSIENT RESPONSE OF PASSIVE PNEUMATIC ISOLATORS
Gary L. Fox and Edward Steiner *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 85-91 refs (See N72-26882 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The dynamic characteristics of pneumatic isolators in their nonlinear region of operation are investigated. A system of equations is derived for the general nonlinear case where the volume change is greater than approximately 10%. The effects of orifice flow damping is included, and comparison between experimental and theoretical results is presented. Author

N72-26893 Naval Ship Research and Development Center, Washington, D.C.
EXPERIMENTAL DETERMINATION OF STRUCTURAL AND STILL WATER DAMPING AND VIRTUAL MASS OF CONTROL SURFACES
Ralph C. Leibowitz and Arthur Kilcullen *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 93-119 refs (See N72-26882 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

An experiment was designed for determining the damping constants and virtual mass for the control surface systems of USS Albacore (AGSS 569) and USS Sampson (DDG10); theoretical methods for determining the virtural inertias (including virtual mass) of these control surfaces are also given. The theoretical foundation for the experimental design and the procedure for analyzing the experimental data to obtain the parameters are described. These damping and inertial parameters are essential to the performance of a hull-control surface vibration and/or flutter analysis. Author

N72-26894 Army Electronics Command, Fort Monmouth, N.J.
DAMPING OF A CIRCULAR RING SEGMENT BY A CONSTRAINED VISCOELASTIC LAYER
C. R. Almy and F. C. Nelson (Tufts Univ., Medford, Mass.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 121-124 refs (See N72-26882 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

An analytical study was made of the variation of the composite loss factor with opening angle and shear stiffness of the viscoelastic layer for a constrained viscoelastic layer on a circular ring segment. There is evidence that optimum damping of a curved beam requires a stiffer viscoelastic layer than the corresponding straight beam. Author

N72-26895 Florida Univ., Gainesville. Dept. of Engineering.
DYNAMIC ANALYSIS OF THE RUNAWAY ESCAPEMENT MECHANISM c15
Gene W. Hemp *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 125-133 refs (See N72-26882 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A mathematical model is developed for the nonlinear damping of the runaway escapement mechanism. A kinematics study develops expressions for the effective linkage ratios between the driving (starwheel) and driven (pallet assembly) members of the escapement for both entrance and exit engagements. The kinetics of the escapement action accounts for six phases of motion during one complete cycle of the pallet assembly and starwheel encounter. Accounting for the variability of the linkage ratios for the first time in an analytical treatment, an expression for the damping of the escapement is derived. This expression is used to predict the behavior of a centrifugally driven mechanism for which experimental information is available. For steady state operation, the equation of motion for such units is solved in terms of elliptic integrals of the first kind. Author

N72-26896 Ballistic Research Labs., Aberdeen Proving Ground, Md.
A METHOD FOR PREDICTING BLAST LOADS DURING THE DIFFRACTION PHASE
W. J. Taylor *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 135-156 (See N72-26882 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Work, directed toward improving the accuracy of the predicted load-time diagram for two- and three-dimensional structures, is presented. The results of this analytical and experimental investigation show substantial differences in loading between two- and three-dimensional cases. A method for determining the load during the diffraction phase is presented and compared to experimental data. Author

N72-26897 Defence Research Establishment Suffield, Ralston (Alberta).
DRAG MEASUREMENTS ON CYLINDERS IN EVENT DIAL PACK
Stanley B. Mellsen *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 157-173 refs (See N72-26882 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The free flight method was used to obtain drag measurements on circular cylinders in the blast wave from a 500 ton TNT burst. Cylinders 3 1/2 to 12 inches in diameter were tested at peak incident overpressures of 5.9 to 20.5 psi. Drag pressure, drag pressure impulses, and drag coefficient were evaluated and tabulated. Transition through critical Reynolds and Mach number regimes were both observed and described. Author

N72-26898 General American Transportation Corp., Niles, Ill. Research Div.
DIAL PACK BLAST DIRECTING EXPERIMENT c14
L. E. Fugelso, S. F. Fields, and W. J. Byrne *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 175-184 refs (See N72-26882 17-32) (Contract DASA01-70-C-0107)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A two-ton TNT blast directing experiment was undertaken to extend the capabilities of the blast directing technique and to verify the accuracy of code predictions and predictions based on scaling considerations. Several individual TNT charges weighing 66 pounds each were distributed over a semicircular disk 37.5 feet in radius and detonated, causing an air blast which was measured by total and side-on pressure gages placed in the one-dimensional flow region and beyond. The experimental data were correlated with smaller yield blast directing data and theoretical predictions, and compared with data from larger yield HE hemispheres. These results show that the two-ton TNT blast directing experiment simulated the air blast, over a limited area, from a larger yield HE detonation. Author

N72-26899 Southwest Research Inst., San Antonio, Tex.
BLAST FIELDS ABOUT ROCKETS AND RECOILLESS RIFLES c34
W. E. Baker, P. S. Westine, and R. L. Bessey *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 185-199 refs (See N72-26882 17-32) (Contract DAAD05-70-C-0170)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The results of an extensive series of measurements that were made on the blast fields generated by recoilless rifles and six different types of solid propellant rocket motors are presented Peak overpressures and positive impulses are reported for blast waves in free air as well as waves reflected from plane surfaces located near the weapons. Test techniques are also described. Model laws are given for scaling pressures and impulses in the blast fields about recoilless rifles, and these laws are corroborated by comparison with experimental results from these and previous tests. Attempts made to generate scaling laws for prediction of blast parameters about rockets proved unsuccessful. Significant differences were observed in the characteristics of pressure fields generated by different rockets, and these differences are discussed. Author

N72-26900*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TRANSONIC ROCKET-SLED STUDY OF FLUCTUATING SURFACE-PRESSURES AND PANEL RESPONSES c11
Eric E. Ungar (Bolt Beranek and Newman, Inc., Cambridge, Mass.), Harry J. Bandgren, Jr., and Robert Erwin *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 201-212 refs (See N72-26882 17-32) (NASA-TM-X-68468) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 14B

Some results are presented of a continuing investigation of the fluctuating pressures on aerospace vehicle surfaces and of the corresponding panel responses. Techniques for predicting fluctuating pressure spectra associated with transonic shock/boundary layer interaction and for estimating correlations and coherences of boundary layer pressures are reviewed and compared with data obtained on a 1/10-scale model of Saturn 5 mounted on a rocket propelled test sled. The agreement is found to be acceptable in general, although the test results exhibit considerable scatter and suffer from some signal/noise ratio problems. At Mach numbers above about 0.6, sound from the propulsion rockets is shown to have no appreciable effect on the fluctuating pressure data obtained on the rocket sled model. Predicted panel responses to the observed fluctuating pressures are found to be in reasonable agreement with corresponding rocket sled data. Author

N72-26901 Naval Ordnance Lab., White Oak, Md.
SUPPRESSION OF FLOW-INDUCED VIBRATIONS BY MEANS OF BODY SURFACE MODIFICATIONS
D. W. Sallet (Md. Univ., College Park) and J. Berezow *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 215-228 refs (See N72-26882 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The flow induced vibrations of an elastically supported cylinder which is exposed to crossflow can be reduced by two methods: one method is to change the parameters of the vibrational system in such a fashion that the approach velocity never equals or exceeds the critical velocity, or, the velocity at which large amplitudes start to occur; and the second method is to reduce the flow induced vibrations by changing the flow around the cylinder, or, to change the surface of the cylinder. The effects of surface modifications on the flow induced vibrations is discussed. It is seen that surface modifications can reduce the amplitudes of the flutter motions. Author

N72-26902 Naval Weapons Center, China Lake, Calif.
AN EXPERIMENTAL TECHNIQUE FOR DETERMINING VIBRATION MODES OF STRUCTURES WITH A QUASI-STATIONARY RANDOM FORCING FUNCTION
Robert G. Christiansen and Wallace W. Parmenter *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 229-251 refs (See N72-26882 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A slender beam is subjected to random vibration. The modes of response of the beam are determined using spectral analysis techniques made available by the NWC spectral analysis computer program. Author

N72-26903 Bell Telephone Labs., Inc., Whippany, N.J.
RESPONSE OF AIR FILTERS TO BLAST
E. F. Witt, C. J. Arroyo, and W. N. Butler *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 253-261 refs (See N72-26882 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Overpressure pulses can enter underground nuclear-blast resistant buildings if blast valves fail to close, or transmitted into the building if such valves be closed directly by the blast itself. Tests simulating these conditions were conducted to determine the degree of damage sustained by commercial air filters and dampers installed close to blast valves, and to determine the magnitude and duration of overpressure pulses which caused no damage or only initial damage. Test results indicated that air filters would be undamaged by long duration pulses with overpressure of about 1.3 psi, and would tolerate higher pressures of shorter duration. No damage should be expected for pulses of 2 to 3 millisecond length with peak pressure of 7 psi. Author

N72-26904 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN, NO. 42. PART 5: SHOCK, VIBRATION, STRUCTURAL ANALYSIS Conference Proceedings
Jan. 1972 255 p refs Presented at 42d Symp. on Shock and Vibration, Key West, Fla., 2-4 Nov. 1971 5 Vol.
(AD-739578; Bull-42-Pt-5) Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Shock and vibration anlaysis of structural components of ships, spacecraft, aircraft, and ordnance items is discussed. For individual titles, see N72-26905 through N72-26929.

N72-26905 Advanced Technology Center, Inc., Dallas, Tex.
BANDWIDTH TIME CONSIDERATIONS IN AUTOMATIC EQUALIZATION c14
Charles T. Morrow *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 1-7 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Automatic equalization of automatic shaker systems is considered. A hypothetical equalizer without feedback is discussed. Feedback and instability, stability with a random or pseudorandom source, and distribution distortion are reviewed. It is concluded that pseudorandom signals are not likely to permit a significant speeding up of the equalizing operation. K.P.D.

N72-26906 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A REGRESSION STUDY OF THE VIBRATION RESPONSE OF AN EXTERNAL STORE
Carl A. Golueke *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 9-15 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The results of a statistical study are presented, in which a stepwise regression computer program was used to determine vibration amplitudes as a function of dynamic pressure and structural surface density. It was determined that vibration amplitudes increased with dynamic pressure, and for the case studied, the vibration response was found to be related to dynamic pressure raised to a power ranging between one and two. Dynamic pressure was effective only above 80 Hz. The effects produced by adding a surface density parameter were mild. The use of surface density weighting in the prediction equation improved the results in the frequency range from 50 to 630 Hz. Author

N72-26907 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
FACTOR ANALYSIS OF VIBRATION SPECTRAL DATA FROM MULTI-LOCATION MEASUREMENTS
Robert G. Merkle *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 17-25 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Factor analysis techniques were employed to classify a number of structural vibration spectra into a smaller number of groups, so that pairs of spectra selected from the same group have similar spectral profiles, while pairs selected from different groups have dissimilar spectral profiles. These groups are compared with other classifications obtained by using various observable structural characteristics. To determine the applicability of such grouping to the vibration prediction problem, statistical tests were employed to determine whether measured vibration spectral densities and computed regression statistics relating vibration to dynamic pressure were significantly more uniform in value for spectra selected from within groups than for spectra selected from different groups. Author

N72-26908 General Electric Co., Cincinnati, Ohio.
RESPONSES OF A MULTILAYER PLATE TO RANDOM EXCITATION
H. Saunders *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 27-35 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Formulas are presented that can be employed to determine the mean square acceleration, displacement and stresses of multilayer plates due to an externally applied random excitation. The derived expressions are general and can be applied to multilayer plates having different boundary conditions. The main theme is slanted towards having all edges of the multilayer plate simply supported. Examples of a three-layered plate and a sandwich plate having an external layer protecting the upper facing are given to illustrate the method. Author

N72-26909 Army Materials and Mechanics Research Center, Watertown, Mass.
RESPONSE OF HELICOPTER ROTOR BLADES TO RANDOM LOADS NEAR HOVER c02
C. Lakshmikantham and C. V. JogaRao *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 37-45 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The response of a flexible helicopter rotor blade to random loading was investigated, the random input being the vertical velocity component. The model takes into account blade flexibility in bending as well as torsion, and also general rotor end fixity. The spectral density and the mean square value of the transverse displacement are computed for both hingeless and hinged rotor blades and the results are evaluated. Author

N72-26910 Naval Weapons Lab., Dahlgren, Va.
INSTRUMENTATION TECHNIQUES AND THE APPLICATION OF SPECTRAL ANALYSIS AND LABORATORY SIMULATION TO GUN SHOCK PROBLEMS c14
D. W. Culbertson and V. F. DeVost (NOL, White Oak, Md.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 47-59 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Instrumentation techniques used and major results are described for measuring the in-bore environment in 5 in. guns, performing spectral analysis of gun shock, and conducting laboratory simulation and correlation studies. Author

N72-26911*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE EFFECT OF Q VARIATIONS IN SHOCK SPECTRUM ANALYSIS

M. B. McGrath and W. F. Bangs *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 61-67 refs (See N72-26904 17-32)
(NASA-TM-X-68463) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 20K

The results of a statistical analysis of shock data are presented in the form of conversion factors that can be used to adjust a spectrum from one value of Q to another. The conversion factors are supplemented with an estimate of the variance and the probability distribution of the data. The data are used to estimate the average number of equivalent cycles of sinusoidal motion present in the complex wave. Author

N72-26912 Army Tank-Automotive Command, Warren, Mich.

RAPID FREQUENCY AND CORRELATION ANALYSIS USING AN ANALOG COMPUTER

Jack G. Parks *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 69-76 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Analog computer circuits are described which provide a complete Fourier analysis of repetitive data signals. The approach is a two-step operation which begins with the computation of the Fourier sine integral of the signal to be analyzed. This integral serves as a low bandpass filter for the frequency difference component of the data signal and the test sine wave signal. The frequency of the test sine wave is increased until a threshold detector indicates that a frequency resonance is present. At this point, a computer subcircuit examines one cycle of the Fourier sine integral and provides outputs which establish the amplitude, phase angle, and frequency of the signal component under study. The main circuit is then allowed to continue until the next frequency component is encountered. Results are presented for special wave forms. Frequency resolution and operational limitations are discussed. Author

N72-26913* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INVESTIGATION OF LAUNCH TOWER MOTION DURING AEROBEE 350 LAUNCH

Ron L. Kinsley and William R. Case *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 77-86 (See N72-26904 17-32)
(NASA-TM-X-68464) Avail: NTIS;Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 20K

Field measurements and a rigid body dynamic analysis of the Aerobee 350 vehicle/tower combination were made to determine the reason for the vehicles dispersion from the predicted impact point. Aerobee launch towers at both Wallops Island, Virginia, and White Sands, New Mexico, were instrumented with accelerometers for several launches. It was discovered that the tower's second mode was consistently excited at launch. The potential for tip-off as a result of the measured tower motion was determined analytically. The excitation mechanism was isolated and found to be a low frequency pressure oscillation in the building hut created by the rocket blast. The recommended solution of the problem was to remove hut panels to prevent the initial pressure buildup. Author

N72-26914 Naval Civil Engineering Lab., Port Hueneme, Calif.

ON THE USE OF FOURIER TRANSFORMS OF MECHANICAL SHOCK DATA c19

H. A. Gaberson and D. Pal *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 87-96 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A simplified proof that the magnitude of the acceleration transform is the residual velocity shock spectrum is given in a form that introduces the running Fourier transform. A method is presented for analyzing high narrow peaks on actual Fourier transforms to determine the excursion associated with the peak frequency. The effect of truncating the record of a slowly decaying transient are also considered. A discussion of the merits of the various transforms is presented. Author

N72-26915 Ballistic Research Labs., Aberdeen Proving Ground, Md.

WAVE ANALYSIS OF SHOCK EFFECTS IN COMPOSITE ARMOR

Gordon L. Filbey, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 97-100 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A rationale for enhanced performance by composite armor in layered configurations against kinetic energy projectiles, hypervelocity particles, and metal jets is given in terms of an analytic model based on one-dimensional nonlinear wave propagation and reflection at material interfaces. Special cases considered are 1-D hydrodynamic shock waves and elastic waves. The model was specifically worked out for the dispersive wave case of a plastically deforming metal in uniaxial stress on one side of a boundary against a linearly elastic metal on the other side, but the principles apply generally. Details of the calculations of the developed stress fields in the two-material case compare favorably with experiment. It is shown that regions occupied by harder materials are those subjected to the larger stresses and thus these harder materials may be thought of as stress raisers. Author

N72-26916 Clarkson Coll. of Technology, Potsdam, N.Y.

STATISTICAL LOADS ANALYSIS TECHNIQUE FOR SHOCK AND HIGH FREQUENCY EXCITED ELASTODYNAMIC CONFIGURATIONS

K. J. Saczalski *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 101-107 refs (See N72-26904 17-32)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A technique for describing deterministic and nondeterministic response characteristics of shock and high frequency-excited elastodynamic systems was extended to determine reactive loads and resulting stresses at desired locations on structural elements within the system. The coupled transcendental elastodynamic equations include the elastic wave effects of continuous mass-distributed structural elements, as well as the inertial effects of arbitrarily shaped rigid bodies. Depending upon the type of excitation imposed on the system, the calculated loads and stresses may be compared to known experimental and analytical failure criteria to establish limits of structural reliability. Author

N72-26917* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NASTRAN OVERVIEW: DEVELOPMENT, DYNAMICS APPLICATION, MAINTENANCE, ACCEPTANCE

J. Philip Raney and Deene J. Weidman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 109-115 (See N72-26904 17-32)
(NASA-TM-X-68465) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: $40.00 per set CSCL 20K

The historical development of the NASTRAN system for structural analysis is briefly reviewed and NASTRAN's present capabilities for dynamic analysis are presented. Specific applications of NASTRAN to vibrations and dynamic response phenomena are illustrated, using typical engineering problems. Plans for the centralized maintenance and future development of

NASTRAN are summarized. Emphasis is placed on NASA's intention to maintain NASTRAN as a valuable national capability. Author

N72-26918 Naval Ship Research and Development Center, Bethesda, Md.

EXPERIENCE WITH NASTRAN AT THE NAVAL SHIP R AND D CENTER AND OTHER NAVY LABORATORIES

Petro Matula *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 129-133 refs (See N72-26904 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The experience accumulated from the use of the NASA structural analysis program NASTRAN is discussed. Steps taken to acquaint engineers in other naval organizations with the program and the current activity of the NASTRAN project at the Naval Ship Research and Development Center are also considered. Author

N72-26919 Washington Univ., St. Louis, Mo. Dept. of Civil and Environmental Engineering.

RESULTS OF COMPARATIVE STUDIES ON REDUCTION OF SIZE PROBLEM

R. M. Mains *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 135-141 refs (See N72-26904 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

Comparative solutions were made for a uniform cantilever beam represented by 20 linear plus 20 rotational coordinates, and for the beam represented by 10 linear coordinates obtained by kinematic condensation. The lower five or six frequencies, mode shapes, and modal effective masses were not altered appreciably by the kinematic condensation operation. An eyeball reduction of mass and a static reduction of stiffness gave equally good results in the lower modes. Author

N72-26920 Lockheed Missiles and Space Co., Sunnyvale, Calif.

STRUCTURAL DYNAMICS OF FLEXIBLE RIB DEPLOYABLE SPACECRAFT ANTENNAS

B. G. Wrenn, W. B. Haile, Jr., and J. F. Hedges *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 143-154 refs (See N72-26904 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The structural dynamic technology problems unique to flexible rib, deployable spacecraft antennas are discussed, covering analysis and testing attendant to deployment and on-orbit configurations. The solution of multiple eigenvalue problems and current results are presented. Limited test results are compared with analytical predictions. Author

N72-26921 Lockheed Missiles and Space Co., Sunnyvale, Calif.

INFLUENCE OF ASCENT HEATING ON THE SEPARATION DYNAMICS OF A SPACECRAFT FAIRING

C. W. Coale and T. J. Kertesz *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 155-166 (See N72-26904 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The problems created by buildup of thermal prestresses in a separable spacecraft fairing are considered. These prestresses are produced by ascent heating of the fairing. When the fairing is cut pyrotechnically above the atmosphere into two halves and jettisoned, the thermal prestresses seriously affect the early postseparation dynamic response of the fairing and can cause the fairing to hang up or to bump the enclosed spacecraft. The problem is evaluated and approaches to both thermal static and structural dynamic analysis are outlined. Results of actual calculations for a large fairing are presented. Author

N72-26922 Florida Univ., Gainesville. Dept. of Aerospace Engineering.

DYNAMIC WAVE PROPAGATION IN TRANSVERSE LAYERED COMPOSITES

C. A. Ross, J. E. Cunningham, and R. L. Sierakowski *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 167-172 refs (See N72-26904 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A method was developed for experimentally determining stress pulse attentuation across a single composite lamina in a solid epoxy rod. The attenuation factor was found to be a function of the initial pulse shape and amplitude. Experimental results are compared with an analytical model. The practical implications of the initial results provide an insight into the prospective fracture/failure damage occurring within composite materials subject to dynamic load. Author

N72-26923 Southwest Research Inst., San Antonio, Tex.

R-W PLANE ANALYSIS FOR VULNERABILITY OF TARGETS TO AIR BLAST

Peter S. Westine *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 173-183 refs (See N72-26904 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The use of a general equation is suggested for defining the vulnerability of any target to an air blast wave. This simple formula could also be used as a code for storing explosives in the vicinity of houses, highways, aircraft, etc. Test data from a variety of different targets including aircraft, cantilever beams, trucks, antennae, cylinders, and houses are used to demonstrate the validity of the equation. Author

N72-26924* Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.

PERFORM: A COMPUTER PROGRAM TO DETERMINE THE LIMITING PERFORMANCE OF PHYSICAL SYSTEMS SUBJECT TO TRANSIENT INPUTS c08

Walter D. Pilkey and Bo Ping Wang *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 185-190 refs (See N72-26904 17-32)
(Grant NGR-47-005-145)
(NASA-CR-127001) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 09B

The PERFORM program has user-oriented computational capability for the evaluation of the limiting performance of multidegree-of-freedom dynamic systems. Appropriate systems are those for which certain maximum response variables, e.g. peak accelerations, stresses, or displacements, are to be minimized, while other maximum response variable are bounded. The user provides system equations of motion in which those portions (isolators) of a system to be evaluated are replaced by functions of time. Sets of constraints, objective functions, and possible transient inputs are also user prescribed. The program then automatically computes the limiting performance characteristics. These characteristics can be employed in the evaluation phase of systems design, by informing the systems engineer whether or not his preliminary design scheme is feasible, and it will guide him in appropriate modifications as the design proceeds and in the selection of optimal hardware. Author

N72-26925 Lockheed Missiles and Space Co., Sunnyvale, Calif.

STRUCTURAL DYNAMIC ANALYSIS AND TESTING OF A SPACECRAFT DUAL TRACKING ANTENNA

D. D. Walters, R. F. Heidenreich, A. A. Woods, Jr., and B. G. Wrenn *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 191-202 (See N72-26904 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

The dynamic characteristics of flexible dual tracking antenna structures subjected to gimbal motor stepping torques are discussed. Structural dynamic technology problems are approached from the analysis and test points of view. The correlation and application of this analysis was used to determine the relevant test data assimilation, test techniques, and instrumentation requirements. Some of the typical problems are pointed out in the design, analysis, and test of deployable antennas (fixed or flexible rib) that are mounted from spacecraft on large flexible booms and are excited by control forcing functions to accurately position the system. Problems such as gear backlash, backup structure flexibility, zero g simulation, instrumentation noise, gear stress, and fatigue are discussed. Author

N72-26926 Naval Research Lab., Washington, D.C.

DETERMINATION OF FIXED BASE NATURAL FREQUENCIES OF A COMPOSITE STRUCTURE OR SUBSTRUCTURES

C. Ni, R. Skop, and J. P. Layher *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 203-213 refs (See N72-26904 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A general technique for determining the fixed base natural frequencies of an in situ, or laboratory, mechanical structure or substructure is presented. The frequencies are obtained semianalytically through a series of response measurements and by utilizing the invariance properties of the mobility elements of the structure. The analysis is based on an arbitrary, conceptual, lumped mass model of an n degree of freedom, undamped, linear, time-invariant system. The technique is also applicable to continuous structures. An extension of the method to damped linear, time-invariant systems was made to study the feasibility of its application in real structures. The fixed base natural frequencies of the lowest two modes of a beam on three supports were determined from theoretical calculations, a standard resonance test, and the technique presented. Author

N72-26927* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

EQUIVALENT SPRING MASS SYSTEM: A PHYSICAL INTERPRETATION

Ben K. Wada, Robert Bamford, and John A. Garba *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 215-225 refs (See N72-26904 17-32)

(Contract NAS7-100)

(NASA-CR-127002) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 20K

A technique is described that generates an equivalent spring mass model for each eigenvector of a structure when the generalized mass and stiffness matrices are available. The physical significance of the equivalent spring mass system and its application in modal testing, identification of eigenvectors, extraction of a lower order model, comparison of similar models, selection of significant eigenvectors, and usage with limited computer programs are discussed. Author

N72-26928* Maryland Univ., College Park. Dept. of Mechanical Engineering.

LONGITUDINAL VIBRATION OF COMPOSITE BODIES OF VARYING AREA

D. J. Guzy, J. C. S. Yang, and W. H. Walston, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 227-234 refs (See N72-26904 17-32)

(Grant NGR-21-002-292)

(NASA-CR-127003) Avail: NTIS; Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set CSCL 20K

The natural frequencies and corresponding mode shapes for composite, axisymmetric bodies of varying area undergoing longitudinal vibrations were determined both experimentally and theoretically. Composite rods, cones and conical shells of Lucite, Nylon, polycarbonate and polyethylene are investigated. Strain measurements were taken from strain gages mounted on the surface of the models which were excited at varying frequencies by a shaker table. Lumped parameter approximations of the continuous bodies were solved numerically on the digital computer for both fixed-free and free-free boundaries in order to determine the natural frequencies, mode shapes and relative strains. The method of characteristics was utilized in a wave propagation approach to obtain the response of a point in the model to a random input. The random input selected was white noise. The natural frequencies were obtained by performing a fast Fourier transform analysis of the response. Author

N72-26929 Gibbs and Cox, Inc., New York.

SIMPLIFIED METHOD FOR THE EVALUATION OF STRUCTUREBORNE VIBRATION TRANSMISSION THROUGH COMPLEX SHIP STRUCTURES

M. Chernjawski and C. Arcidiacono *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 5 Jan. 1972 p 235-243 refs (See N72-26904 17-32)

Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

A simplified method for analyzing the transmission of vibration in ship structures is presented. The reflection and transmission of bending and longitudinal elastic waves in plates or beams forming cross-shaped connections was investigated. The propagation of bending waves through an infinitely long plate which is stiffened by structural elements of arbitrary shape was also analyzed. Finally, a multipath plane structure was investigated for bending wave transmission. Author

N72-26930 Waterloo Univ. (Ontario). Solid Mechanics Div.

QUALITATIVE STABILITY THEORY OF COMPLETELY SUPPORTED RODS SUBJECTED TO FOLLOWER FORCES

H. H. E. Leipholz and R. N. Dubey Jan. 1972 44 p refs Submitted for publication

(Grant NRC A-7297)

(Rept-104) Avail: Issuing Activity

Energy considerations are used to determine the slope and the curvature of the eigenvalue curves of completely supported rods. The trace of the eigenvalue curves is then predicted by means of the slope and the curvature, thus proving that rods subjected to tangential follower forces are either of the divergence or of the pseudo-divergence type, and that rods subjected to an airstream are of the flutter type. The prediction of this trace also yields the lower and upper bounds for the buckling loads. Since the bounds can be evaluated by solving linear equations, these are obtained easily and prove valuable for the engineer in practice. Author

N72-26931# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

ELASTO-VISCO-PLASTIC CONSTITUTIVE EQUATIONS FOR QUASI-STATIC STRUCTURES CALCULATIONS

Jean Lemaitre 1972 37 p refs Presented at Summer Course on the Dyn. of Inelastic Mater., Jablonna, Poland, 8-13 May 1972

(ONER-TP-1089) Avail: NTIS HC $4.00

The development of elasto-visco-plastic constitutive equations for quasi-static structures calculations is discussed. The equations are verified for the stable materials used in mechanical construction and are extended to conditions of varying temperature and to nonstable materials. the equations are generalized to the three dimensional isotropic case under the form of a tensorial differential law. A theorem is presented to analyze the conditions of existence of the simple loading path for a structure of any shape. Author

N72-26932*# Naval Postgraduate School, Monterey, Calif.

A DIGITAL COMPUTER STUDY OF THE BUCKLING OF SHALLOW SPHERICAL CAPS AND TRUNCATED

HEMISPHERES
William C. Stilwell and Robert E. Ball Washington NASA Jun. 1972 76 p refs
(NASA Order L-16438)
(NASA-CR-1998) Avail: NTIS HC $3.00 CSCL 20K

A study of the buckling of thin shells was conducted using a digital computer program for the geometrically nonlinear analysis of arbitrarily loaded shells of revolution. The objective was an evaluation of the program's applicability to bifurcation buckling and imperfection sensitivity analysis. Clamped spherical caps under pressure loading and clamped truncated hemispheres under axial tension were investigated. Buckling loads were determined for axisymmetric and nearly axisymmetric loads and are compared with previously published analytical results based on geometric imperfections. Author

N72-26933*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DISCONTINUITY STRESSES IN METALLIC PRESSURE VESSELS NASA Space Vehicle Design Criteria (Structures)
Nov. 1971 69 p refs
(NASA-SP-8083) Avail: NTIS HC $3.00 CSCL 20K

The state of the art, criteria, and recommended practices for the theoretical and experimental analyses of discontinuity stresses and their distribution in metallic pressure vessels for space vehicles are outlined. The applicable types of pressure vessels include propellant tanks ranging from main load-carrying integral tank structure to small auxiliary tanks, storage tanks, solid propellant motor cases, high pressure gas bottles, and pressurized cabins. The major sources of discontinuity stresses are discussed, including deviations in geometry, material properties, loads, and temperature. The advantages, limitations, and disadvantages of various theoretical and experimental discontinuity analysis methods are summarized. Guides are presented for evaluating discontinuity stresses so that pressure vessel performance will not fall below acceptable levels. Author

N72-26934*# Aerophysics Research Corp.,
APPLICATION OF MULTIVARIABLE SEARCH TECHNIQUES TO STRUCTURAL DESIGN OPTIMIZATION
R. T. Jones and D. S. Hague Washington NASA Jun. 1972 218 p refs
(Contract NAS1-9936)
(NASA-CR-2038) Avail: NTIS HC $3.00 CSCL 20K

Multivariable optimization techniques are applied to a particular class of minimum weight structural design problems: the design of an axially loaded, pressurized, stiffened cylinder. Minimum weight designs are obtained by a variety of search algorithms: first- and second-order, elemental perturbation, and randomized techniques. An exterior penalty function approach to constrained minimization is employed. Some comparisons are made with solutions obtained by an interior penalty function procedure. In general, it would appear that an interior penalty function approach may not be as well suited to the class of design problems considered as the exterior penalty function approach. It is also shown that a combination of search algorithms will tend to arrive at an extremal design in a more reliable manner than a single algorithm. The effect of incorporating realistic geometrical constraints on stiffener cross-sections is investigated. A limited comparison is made between minimum weight cylinders designed on the basis of a linear stability analysis and cylinders designed on the basis of empirical buckling data. Finally, a technique for locating more than one extremal is demonstrated. Author

N72-26935# Waterloo Univ. (Ontario). Solid Mechanics Div.
THE RESPONSE OF SYSTEM WITH DOUBLE BILINEAR-HYSTERESIS TO RANDOM EXCITATION
B. Sahay and S. Oen Jul. 1970 16 p refs
(Grants NRC A-1815)
(Rept-57) Avail: NTIS HC $3.00

The response of a system with double-bilinear-hysteresis to random excitation is presented. It is shown that for a specific region, the mean square deflection is less than that of the linear system with the same viscous damping. Compared to the system with bilinear hysteresis, the mean square deflection is smaller for the present system, and thus a considerably sluggish behaviour can be observed for the same amount of inputs excitation to the corresponding equivalent bilinear systems. Author

N72-26936# Calgary Univ. (Alberta). Dept. of Civil Engineering.
FINITE DEFLECTIONS OF UNIFORMLY LOADED, CLAMPED, RECTANGULAR, ANISOTROPIC PLATES
C. Y. Chia Dec. 1971 45 p refs Backup document for AIAA Synoptic scheduled for publication in the AIAA Journal in Nov. 1972 Sponsored by Natl. Res. Council of Can.
(CE-71-29) Avail: NTIS HC $4.25

The von Karman-type nonlinear differential equations of uniformly loaded, clamped, rectangular, anisotropic plates expressed in terms of three displacements are solved by the perturbation technique. The solution is then specified for generally orthotropic, orthotropic, and isotropic plates. Load deflection relations, bending moments, and membrane forces are presented in graphical form for some high modulus fiber-reinforced composite plates with various aspect ratios. The results for small deflections of isotropic and anisotropic plates and large deflections of isotropic plates are in good agreement with available data. Author

N72-26937# Lockheed Missiles and Space Co., Palo Alto, Calif.
STABILITY OF CYLINDRICAL AND CONICAL SHELLS WITHIN WHICH A SUPERSONIC GAS FLOWS
N. A. Kilchevskii, ed. 1970 39 p refs Transl. into ENGLISH from the book "Mekhanika Sistem Obolochka Zhidkost Nagretyi Gas" Naukova Dumka, Kiev, 1970 p 173-221
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A numerical analysis of the stability of cylindrical and conical shells containing a supersonic gas flow is presented. It is assumed that the gas is inviscid, isentropic, with a velocity which is constant along the length and uniform in cross section. The material of the shell is considered to be homogeneous, isotropic, and subject to Hooke's law. A complete system of equations and boundary conditions which are needed to investigate the vibrations and stability of the circular shell are developed. Mathematical models are included to support the theoretical considerations. Author

N72-26938*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OPTIMUM MASS-STRENGTH ANALYSIS FOR ORTHOTROPIC RING-STIFFENED CYLINDERS UNDER AXIAL COMPRESSION
John L. Shideler, Melvin S. Anderson, and L. Robert Jackson Washington Jul. 1972 54 p refs
(NASA-TN-D-6772; L-7060) Avail: NTIS HC $3.00 CSCL 20K

An analysis was developed to calculate the minimum mass-strength curve for an orthotropic cylinder subjected to axial compressive loading. The analysis, which includes the effects of ring and stringer eccentricities, is in a general form so that various cylinder wall and stiffener geometries can be considered. Several different ring-stiffened orthotropic configurations were studied. The minimum mass-strength curves and the dimensions associated with these curves are presented for (in order of decreasing efficiency) a tubular double bead, a nonsymmetric double bead, a Z-stiffened skin, and a trapezoidal corrugation. A comparison of efficiencies of the configurations shows a tubular element cylinder to be more efficient than a 3-percent core-density honeycomb-sandwich cylinder. It was found that for an optimized Z-stiffened skin, the location of the Z-stiffeners (internal or external) made a negligible difference in efficiency. Author

N72-26939*# Boeing Co., Seattle, Wash.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF AIRCRAFT METAL STRUCTURES REINFORCED WITH

FILAMENTARY COMPOSITES. PHASE 2: STRUCTURAL FATIGUE, THERMAL CYCLING, CREEP, AND RESIDUAL STRENGTH
B. Blichfeldt and J. E. McCarty Washington NASA Jun. 1972 111 p refs
(Contract NAS1-8858)
(NASA-CR-2039; D6-60136-2) Avail: NTIS HC $3.00 CSCL 20K

Specimens representative of metal aircraft structural components reinforced with boron filamentary composites were manufactured and tested under cyclic loading, cyclic temperature, or continuously applied loading to evaluate some of the factors that affect structural integrity under cyclic conditions. Bonded, stepped joints were used throughout to provide composite-to-metal transition regions at load introduction points. Honeycomb panels with titanium or aluminum faces reinforced with unidirectional boron composite were fatigue tested at constant amplitude under completely reversed loading. Results indicated that the matrix material was the most fatigue-sensitive part of the design, with debonding initiating in the stepped joints. However, comparisons with equal weight all-metal specimens show a 10 to 50 times improved fatigue life. Fatigue crack propagation and residual strength were studied for several different stiffened panel concepts, and were found to vary considerably depending on the configuration. Composite-reinforced metal specimens were also subjected to creep and thermal cycling tests. Thermal cycling of stepped joint tensile specimens resulted in a ten percent decrease in residual strength after 4000 cycles. Author

N72-26940# Asian Inst. of Tech., Bangkok (Thailand).
THE CONCENTRIC AND ECCENTRIC SHEAR STRENGTHS OF WELDED CONNECTIONS M.S. Thesis
Worawit Kampanya 1970 92 p refs
(AIT-Thesis-299) Avail: NTIS HC $6.75

Experimental investigations of the concentric and eccentric shearing resistance of fillet welded connections are reported. Twelve longitudinal and six transverse fillet welds were tested under concentric load to make a critical evaluation of the increase in the allowable stress for fillet welds in the current AISC Specification. The shortcomings of the conventional design method for eccentrically loaded welded connections were studied by means of eighteen steel brackets tested under eccentric load. The weld groups studied were two-sided welds, C-shaped welds and completely closed welds. The angle of rotation and center of rotation of the connections were measured. All tests were performed to failure. The observed values in both investigations were compared to the corresponding theoretical values. Based on the test results, pertinent conclusions were drawn and recommendations for proportioning eccentrically loaded welded connections were developed. Author

N72-26941# Asian Inst. of Tech., Bangkok (Thailand).
THE EFFECT OF JOINT RIGIDITY ON FRAME STABILITY M.S. Thesis
Suphot Phongkidakarn 1970 123 p refs
(AIT-Thesis-298) Avail: NTIS HC $8.25

The behavior of semi-rigid steel frames is discussed. The joint rigidity is varied from that of a hinge to that of a fully rigid joint. Frame stability and mechanism resistance of frames are the limiting conditions studied. The frame is assumed to be laterally braced in the direction perpendicular to the plane of loading. It is assumed that failure occurs by bending in the plane of the applied moment. In analyzing frame stability, the effect of thrust in the columns, yielding in the beam, and residual stress in the members are included. The limiting moment resistance of double web angle connections and seat and clip angle connections is developed as a function of connection stiffness. The frames considered are acted upon by a symmetrical load on the beam and additional equal concentrated loads on each column. Author

N72-26942# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ELASTO-VISCO-PLASTIC CONSTITUTIVE EQUATIONS FOR QUASI-STATIC STRUCTURES CALCULATIONS
Jean Lemaitre 1972 37 p refs Presented at Summer Course on the Dyn. of Inelastic Mater., Jablonna, Poland, 8-13 May 1972
(ONERA-TP-1089) Avail: NTIS HC $4.00

The development of elasto-visco-plastic constitutive equations for quasi-static structures calculations is discussed. The equations are verified for the stable materials used in mechanical construction and are extended to conditions of varying temperature and to nonstable materials. The equations are generalized to the three dimensional isotropic case under the form of a tensorial differential law. A theorem is presented to analyze the conditions of existence of the simple loading path for a structure of any shape. Author

N72-26943# Oak Ridge National Lab., Tenn.
ELASTIC BUCKLING OF HEATED, STRAIGHT-LINE PIPING CONFIGURATIONS
John E. Brock Mar. 1972 66 p refs Sponsored by AEC
(Contract W-7405-eng-26)
(ORNL-TM-3607) Avail: NTIS

The behavior of a straight pipe, constrained at the ends against displacement and subjected to an increase in temperature is discussed. At a certain critical temperature the pipe abandons its originally straight configuration and begins bowing to the side. Considering elastic behavior, it is found that maximum stress increases (roughly) linearly with temperature below the critical value and as the square root of temperature in excess of the critical value. Because there may be practical difficulties in estimating effective pipe length, a formula is given for maximum possible stress for a given temperature, regardless of pipe length. The influence of internal pressure is also considered. Actual variations of material properties as functions of temperature are accounted for, although, as it is shown, excellent approximations are easily obtained by assuming that material properties are constant. The practical case of a pipe supported by rigid hangers is created by considering an equivalent lateral elastic foundation. Author

N72-26944# National Aerospace Lab., Amsterdam (Netherlands).
STIFFNESS MATRIX FOR A TAPERED SPAR ELEMENT
J. vanderVooren 29 Apr. 1970 63 p refs Sponsored by Neth. Aircraft Develop. Board
(NLR-TR-70052-V) Avail: NTIS HC $5.25

A class of tapered spar elements is developed and tested. The effect of warpage of the cross-section under transverse shear load and the influence of varying deflection over the depth of the spar are investigated. Author (ESRO)

N72-26945# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
FUNDAMENTAL FREQUENCIES OF PLANE MULTISTOREY FRAMES OF MODULAR FORM
D. W. Martin and E. L. Albasiny Jan. 1972 31 p refs
(NPL-NAC-3) Avail: NTIS HC $6.75

The fundamental frequencies are formulated for regular, rectangular plane building frames, composed of identical columns and identical floor beams, with rigid joints and with the lowest columns clamped at their base. On the assumption that the axial compression of the floor beams and the shear deformation of all individual members is negligible, and that the fundamental frequency of such a frame is not affected significantly by vertical and rotary accelerations, it is shown that a nondimensional form of this frequency depends only on the number of bays, storeys, and two nondimensional parameters. Diagrams are presented of the nondimensional frequency, and certain features of the computed results are confirmed analytically. Author (ESRO)

N72-26946# Catholic Univ. of America, Washington, D.C.
STABILITY OF PLATES WITH CUT-OUTS
Nicholas L. Basderas Feb. 1971 18 p refs Sponsored in part by ONR

(Grant NSF GK-23747)
(AD-731715) Avail: NTIS CSCL 20/11

The load carrying capacity of plates is an area of great interest to the structural engineer. At times operational requirements and/or the desire to reduce the weight of the structure requires the introduction of cut-outs. It is expected that the size, shape and location of the cut-out will have an effect on the load carrying capacity of the plates. Unless this effect can be determined reliably the strength to weight ratio of the plate with cut-out(s) could not be optimized. The technique to be used in this paper to determine the stability of plates with cut-outs makes use of the mode shapes and frequencies of the plates without the cut-outs, which is considered the reference structure, having the same boundary conditions as the plates with the cut-outs. Author (GRA)

N72-26947# Watervliet Arsenal, N.Y. Benet R and E Labs.
INELASTIC BEHAVIOR OF THICK WALL CYLINDERS
John D. Vasilakis Dec. 1971 30 p refs
(DA Proj. 1T0-61102-B-33-A)
(AD-738843; WVT-7166) Avail: NTIS CSCL 20/11

Thick-walled cylinders were tested under pressure for various end conditions. The two materials used were annealed copper and C1045 steel in the annealed condition. Pressurization continued until the tubular specimens were fully plasticized, i.e. uncontained plastic flow has occurred. Tests were conducted with the specimens in the open end, closed end and closed end with an applied axial load position. Material properties were also derived experimentally with the use of tensile specimens and thinwalled cylinders. The modulus of elasticity, Poisson's ratio and the strain hardening factor were found for each material. Author (GRA)

N72-26948# Naval Postgraduate School, Monterey, Calif.
A FINITE ELEMENT METHOD FOR OPTIMUM BEAM DESIGN M.S. Thesis
Ralph Louis Santi Dec. 1971 101 p refs
(AD-738918) Avail: NTIS CSCL 13/13

A finite element method for structural optimization of a prismatic beam of a homogeneous, isotropic material is developed. The beam has a rectangular cross-section of constant fixed height, a fixed length, and a fixed volume. Structural optimum is defined as that shape which allows a maximum load within the elastic range. A computer program is developed to solve the resulting system of equations and various example problems are solved. Comparison is made with exact optimum beam designs where possible. The finite element model is able to solve problems with any boundary conditions and types of loading that are consistent with the number of elements selected.
Author (GRA)

N72-26949# Naval Postgraduate School, Monterey, Calif.
A GENERAL PURPOSE THREE DIMENSIONAL STRESS ANALYSIS PROGRAM
Emmanuel Leonidas Dec. 1971 172 p refs
(AD-738906) Avail: NTIS CSCL 20/11

A computerized solution for three dimensional stress analysis was developed. The solution was based on the finite element technique employing twenty and thirty-two nodal point three dimensional isoparametric elements. The solution is applicable to linear elastic structures composed of homogeneous and isotropic materials subjected to static loading under constant temperature. Deformed states are restricted to small displacements and displacement gradients. The program is coded in standard FORTRAN IV and is machine independent except for one subroutine which may be adjusted to specific installations. Independence of core space requirements is achieved by use of direct access storage facilities. Author (GRA)

N72-26950# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
FATIGUE CRACK GROWTH IN WELDED BEAMS
M. A. Hirt and J. W. Fisher Jan. 1972 43 p refs
(Contract N00014-68-A-0514)
(AD-738448; FEL-358.35) Avail: NTIS CSCL 13/13

The fatigue behavior of welded steel beams is evaluated using the fracture mechanics concepts of stable crack growth. A fracture mechanics model for cracks originating from the pores in the web-to-flange fillet weld is developed. Estimates of the stress-intensity factor are made that numerically describe the initial flaw condition. With the final crack size known, a theoretical crack-growth equation was derived from the fatigue test data of the welded beams. The derived relationship compares well with actual crack-growth measurements on a welded beam and available data from crack growth specimens.
Author (GRA)

N72-26951# Notre Dame Univ., Ind. Coll. of Engineering.
THEORIES OF ELASTIC SLENDER CURVED RODS
N. C. Huang Feb. 1972 40 p refs
(Contract N00014-68-A-0152; NR Proj. 260-112)
(AD-738457; UND-72-3) Avail: NTIS CSCL 13/10

The linear and nonlinear theories of elastic slender curved rods are formulated in a systematic manner. Equations of equilibrium for stress resultants and moments are derived. The generalized strains are defined based on the principle of virtual work. Constritutive equations corresponding to small strains are obtained. The field equations for finite deformations of curved rods can be simplified in the case of small axial strain and moderately small rotations. Further simplifications can be made for the case of slightly curved rods. Two examples are presented to illustrate applications of the developed theories.
Author (GRA)

N72-26952# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
CRACK PROPAGATION IN A STRIP OF MATERIAL UNDER PLANE EXTENSION
G. C. Sih and E. P. Chen Nov. 1971 34 p refs
(Contract N00014-68-A-0514)
(AD-738451; FEL-358.D13; ISFM-71-10) Avail: NTIS CSCL 20/11

The problem of a uniformly propagating crack in a strip of elastic material is solved using the dynamic equations of elasticity in two dimensions. Two specific conditions of loading on the strip with finite width are discussed. In the first case, the rigidly clamped edges are pulled apart in the opposite directions. The second case considers equal and opposite directions. The second case considers the strip width to the crack length ratio, the amplitude of the dynamic stresses ahead of the running crack is determined as a function of the crack velocity. The local dynamic stresses are found to be lower than the corresponding static values for the displacement loading condition and higher for the stress loading condition. This effect becomes increasingly more important as the crack length to strip width ratio is enlarged. Numerical results for the dynamic crack opening displacements are also presented. GRA

N72-26953# California Univ., San Diego. Dept. of Aerospace and Mechanical Engineering Sciences.
FIBER COMPOSITE COLUMNS UNDER COMPRESSION
Yoram N. Lanir and Yuan-Cheng B. Fung Jun. 1971 40 p refs
(Grant AF-AFOSR-1957-70; AF Proj. 9728)
(AD-739257; AFOSR-71-3029TR) Avail: NTIS CSCL 13/13

The micromechanics of fiber composite columns under compression is investigated theoretically. The model is based on the assumption that the fiber buckles inside the matrix under critical load. In the postbuckling range the fiber is considered as a beam on elastic foundation. The value of the foundation constant is evaluated for the case of a long fiber encased in a cylinder. It is shown that prebuckling separation between fiber and matrix affects the critical buckling load and the postbuckling behaviour of the fiber. Computations based on the proposed model show that in the linear elastic range of common materials the buckling of the fiber does not affect significantly the overall mechanical behaviour of the composite. Author (GRA)

N72-26954# State Univ. of New York at Buffalo. Dept. of Civil Engineering.
DESIGN OF TAPERED MEMBERS Final Report, Feb. 1966 - Dec. 1971
George C. Lee, M. L. Morrell, and Robert L. Ketter Dec. 1971 129 p refs
(Contract NBY-63864; YR0090303)
(AD-738722) Avail: NTIS CSCL 13/13

The report covers all major aspects of the design of tapered frames; from total frame analysis to stress analysis of individual members - to the development of tapered design formulas. The primary objective of the report is to present the rationale behind the development of the design formulas. Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N72-26955 Polytechnic Inst. of Brooklyn, N.Y.
TURBULENT HEAT AND MASS TRANSFER IN AXISYMMETRIC JETS Ph.D. Thesis
Robert Francis Mons 1971 138 p
Avail: Univ. Microfilms Order No. 71-29083

The problem of turbulent mixing is examined with emphasis on mass, momentum, and energy transport in an axisymmetric free jet. An experimental investigation of the response of a pitot tube, a thermocouple, and a sampling probe to a known periodic fluctuating flow with variable intensity of fluctuations is performed. The results indicate that the pitot tube response yields an adequate measure of the mean momentum flux in the incompressible range for any level of velocity fluctuation intensity in the direction of the probe axis. On the other hand, the thermocouple and sampling probe are found to be subject to significant errors in the measurement of mean temperature and mean concentration, respectively, in the high shear regions of a turbulent free jet. Dissert. Abstr.

N72-26956 Louisiana State Univ., Baton Rouge.
THE MACH DISC IN AXISYMMETRIC ROCKET PLUMES Ph.D. Thesis
Richardo Jesus Jofre 1971 214 p
Avail: Univ. Microfilms Order No. 71-29376

The strong shock wave found in some axisymmetric plumes was studied. The location of the strong shock, called the Mach disc, was found by solving the time-dependent servation equations. These equations were integrated forward in time in a high speed computer until the solution converged to the steadystate solution. The Mach disc location was determined within the accuracy of reported experimental measurements. A damping scheme was necessary to maintain stability. It is recommended that additional logic be incorporated into the reported computer program in order to obtain more accurate flow conditions downstream of the Mach disc. Dissert. Abstr.

N72-26957 Connecticut Univ., Storrs.
EXPERIMENTAL INVESTIGATION OF VORTEX SHEDDING AND ENTHALPY MEASUREMENT TECHNIQUES USING A HIGH-TEMPERATURE ARC GENERATOR SOURCE Ph.D. Thesis
Richard James Henry 1971 124 p
Avail: Univ. Microfilms Order No. 71-29873

A 10-kilowatt, arc generator system was developed to produce a stable and symmetric source of high-temperature gas for basic aerodynamic and heat transfer studies. Using a continuously variable, water-cooled resistor, power supply characteristics were matched with particular arc gas requirements. A special startup procedure for the generator was developed utilizing a high-frequency voltage supply. Using the arc generator source, investigations were made of the effect that elevating the free stream gas temperature would have on the characteristic measured property - the vortex shedding frequency. It was possible to measure the periodic nature of the wake flow behind circular cylinders using resultant oscilloscope traces from hot wire instrumentation located downstream of the cylindrical disturbance. Dissert. Abstr.

N72-26958*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
SUPPRESSION OF COMBUSTION OSCILLATIONS WITH MECHANICAL DAMPING DEVICES Final Report, 27 Jun. 1970 - 29 Feb. 1972
12 Jun. 1971 91 p refs
(Contract NAS8-21310)
(NASA-CR-123721; PWA-FR-4993) Avail: NTIS CSCL 20M

Nonarray absorbing devices were investigated for use in rocket thrust chambers as instability suppressors. A theory for designing absorbing devices suitable for rocket application is derived, and a nonarray computer program is developed. The experimental program used to verify the theory is discussed. It is concluded that individual acoustical devices can be designed for maximum energy absorption, and it is recommended that single resonators be designed so that the ratio of the aperture diameter to the product of the quarter-wave length and cavity backing depth is less than one. F.O.S.

N72-26959# Naval Ordnance Lab., White Oak, Md.
EXPLOSIVES FOR LUNAR SEISMIC PROFILING EXPERIMENT
Carroll C. Misener 15 May 1972 26 p
(NOLTR-72-95) Avail: NTIS HC $3.50 CSCL 19A

The procedures involved in the preparation of explosive charges for use in the seismic studies conducted on the surface of the moon are described. The scaling up of the blending of materials for the inert simulant, as well as the HNS/Teflon explosive, was accomplished. The pressing, machining, and assembling of the charges into hardware shapes is examined. Author

N72-26960*# Princeton Univ., N.J. Guggenheim Labs. for the Aerospace Propulsion Sciences.
COMBUSTION ANOMALIES IN STOP-RESTART FIRING OF HYBRID ROCKET ENGINES
Michael A. Saraniero, L. H. Caveny, and M. Summerfield Sep. 1970 86 p refs
(Grant NGR-31-001-109)
(NASA-CR-127043; AMS-945) Avail: NTIS HC $6.50 CSCL 21B

An experimental investigation of the restart process of an oxygen-Plexiglas hybrid rocket demonstrated that preheating the fuel (as a consequence of a previous ignition and a temporary extinguishment) significantly increases the rate of chamber pressurization and produces regression rate overshoots during reignition. Higher rates of chamber pressurization measured during the restart transient imply faster instantaneous regression rates of the fuel during restart. Transient periods following the initial ignition and the restart after a two-second shutdown were observed for four experimental tests. Thermocouples were embedded in the fuel to record subsurface temperature histories. A mathematical model of the thermal processes in the fuel and the events that occur during an experimental firing was developed to calculate the regression rate transients. Quantitative agreement with experimental results was obtained by making nominal corrections to the calculated convective and radiative heating rates. Author

N72-26961# Defence Standards Labs., Maribyrnong (Australia).
STEADY STATE SHELL COOLING COMPUTATIONS AND FORMER DESIGN

D. J. Peck Mar. 1972 31 p refs
(TN-226) Avail: NTIS HC $3.75

A computer program for simulating the conductions created by castable high explosive fillings when poured into shells is presented. The program makes it possible to determine the conditions under which the explosive is poured and allowed to solidify in order to prevent cracking due to thermal stresses. A description of the computer program and the data used for shell cooling calculations are presented, together with recommendations on the best type of formers to use for the shaping of exploder cavities. Author

N72-26962# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
COMPARISON OF MEASUREMENTS ON RELAXING FIRE GASES IN A NOZZLE FLOW WITH CHEMICAL KINETIC CALCULATIONS Ph.D. Thesis
H. Pippert 1971 134 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-33) Avail: NTIS HC $8.75; DFVLR Porz-Wahn: 37,90 DM

Due to chemical relaxation procedures in expansion nozzles of rockets and ramjet engines recombination losses occur. Tests were performed to investigate these losses. A shock wave tube was used to generate gas detonation. The expansion of the nozzle was analysed by means of a computer which takes into account the chemical kinetic procedures in the gas. Measurements were compared and rate constants of the most influential reactions $H + OH + M$ yields $H_2O + M$ and $O + O + M$ yields $O_2 + M$ could be determined. Finally the approximation method by Bray/Penner was compared with the exact results. Author

N72-26963*# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
MATHEMATICAL MODELING OF HIGH AND LOW TEMPERATURE HEAT PIPES Final Report
S. W. Chi Dec. 1971 94 p refs
(Grant NGR-09-010-070)
(NASA-CR-122419) Avail: NTIS HC $6.75 CSCL 20M

Following a review of heat and mass transfer theory relevant to heat pipe performance, math models are developed for calculating heat-transfer limitations of high-temperature heat pipes and heat-transfer limitations and temperature gradient of low temperature heat pipes. Calculated results are compared with the available experimental data from various sources to increase confidence in the present math models. Complete listings of two computer programs for high- and low-temperature heat pipes respectively are included. These programs enable the performance to be predicted of heat pipes with wrapped-screen, rectangular-groove, or screen-covered rectangular-groove wick. Author

N72-26964*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REVIEW OF CRITICAL FLOW RATE, PROPAGATION OF PRESSURE PULSE, AND SONIC VELOCITY IN TWO-PHASE MEDIA
Yih-Yun Hsu Washington Jun. 1972 45 p refs
(NASA-TN-D-6814; E-6389) Avail: NTIS HC $3.00 CSCL 20M

For single-phase media, the critical discharge velocity, the sonic velocity, and the pressure pulse propagation velocity can be expressed in the same form by assuming isentropic, equilibria processes. In two-phase mixtures, the same concept is not valid due to the existence of interfacial transports of momentum, heat, and mass. Thus, the three velocities should be treated differently and separately for each particular condition, taking into account the various transport processes involved under that condition. Various attempts are reviewed to predict the critical discharge rate or the propagation velocities by considering slip ratio (momentum change), evaporation (mass and heat transport), flow pattern, etc. Experimental data were compared with predictions based on various theorems. The importance is stressed of the time required to achieve equilibrium as compared with the time available during the process, for example, of passing a pressure pulse. Author

N72-26965*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFLUENCE OF POROUS-WALL THERMAL EFFECTIVENESS ON TURBULENT-BOUNDARY-LAYER HEAT TRANSFER
Mel R. Lecuyer and Raymond S. Colladay Washington Jun. 1972 26 p refs
(NASA-TN-D-6837; E-6711) Avail: NTIS HC $3.00 CSCL 20M

In view of the interest in employing porous wall materials for which the wall thermal effectiveness is less than unity, the influence of the effectiveness on the convective heat-transfer coefficient is examined. A Couette-flow model of the turbulent boundary layer shows that the familiar expression for the Stanton number with mass transfer at the boundary is modified by a correction factor that accounts for the wall thermal effectiveness and the effectiveness of the film layer in protecting the surface from the hot gas stream. The correction term is found be of considerable importance for low values of blowing rate and wall thermal effectiveness. Author

N72-26966*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF HEAT-TRANSFER CHARACTERISTICS OF TWO AIR-COOLED TURBINE BLADES TESTED IN A TURBOJET ENGINE
Gerald E. Fallon and John N. B. Livingood Washington Jun. 1972 28 p refs
(NASA-TM-X-2564; E-6822) Avail: NTIS HC $3.00 CSCL 20M

Two air-cooled blades were tested to gas temperatures of 2568 F with coolant temperatures to 764 F. Both average and local blade temperatures were correlated over the range of operating conditions. Calculated and measured blade wall temperatures are compared. Potential operating turbine-inlet temperatures of each blade are discussed. Author

N72-26967*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND PERFORMANCE EVALUATION OF A CRYOGENIC CONDENSER FOR AN IN-PILE EXPERIMENT
Robert W. Graham, Richard J. Crum, and Yih-Yun Hsu Washington Jun. 1972 11 p refs
(NASA-TM-X-2574; E-6868) Avail: NTIS HC $3.00 CSCL 20M

An apparatus was designed to enable in-pile irradiation of materials in liquid hydrogen at cryogenic temperatures. One of the principal components of this apparatus was a horizontal tube condenser. The performance of the condenser was evaluated by running a liquid-nitrogen prototype of the apparatus at heat loads comparable to or greater than those expected during the irradiation. The test showed that the condenser was capable of handling the design heat load and that the design procedure was sound. Author

N72-26968*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A SWIRL-CAN COMBUSTOR AT IDLE CONDITIONS
Richard W. Niedzwiecki, Arthur M. Trout, and Edward Mularz Washington Jun. 1972 11 p refs
(NASA-TM-X-2578; E-6892) Avail: NTIS HC $3.00 CSCL 20M

Test results of a full annulus swirl-can combustor operated at simulated engine idle conditions indicated that significant improvements in combustion efficiency and accompanying reductions in pollutants could be realized with radial scheduling of fuel. Test conditions were an inlet air temperature of 478 K, a pressure of 4 atmospheres, and a reference velocity of 26 meters per second. At a fuel-air ratio of 0.008, radial scheduling of fuel increased combustion efficiency from less than 50 percent with no scheduling to nearly 100 percent and produced emission index values of unburned hydrocarbons and carbon monoxide of 10 and 40, respectively. Author

N72-26969# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

ANALYSIS OF ELECTROMAGNETIC SCATTERING FROM TURBULENT LOW ALTITUDE ROCKET PLUMES

T. Luzzi Jun. 1972 49 p refs Presented at the 1st Meeting of the Joint US, UK, Australia, Canada, Tech. Cooperation Program (Plume Tech. Group), China Lake, Calif., 28-30 Mar. 1972
(RE-429J) Avail: NTIS HC $4.50

A theoretical study was made of the scattering of electromagnetic waves from both underdense and overdense turbulent low altitude rocket plumes. The analysis considers a number of parametric assumptions about the nature of the turbulence, namely, type of correlation function, correlation lengths, isotropy of turbulence, finite conductivity, and plume intermittency. The analytical results were applied to the cross sections of both an underdense and overdense plume at 65,000 ft altitude. The most important result is that the theoretical cross section can be large for some reasonable assumptions about the nature of the plume turbulence. Author

N72-26970*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IDENTIFICATION OF BOILER INLET TRANSFER FUNCTIONS AND ESTIMATION OF SYSTEM PARAMETERS

Jeffrey H. Miles 1972 14 p refs Proposed for presentation at 1972 Joint Autom. Control Conf., Stanford, Calif., 16-18 Aug. 1972; sponsored by AIAA
(NASA-TM-X-68075; E-6485) Avail: NTIS HC $3.00 CSCL 20M

An iterative computer method is described for identifying boiler transfer functions using frequency response data. An objective penalized performance measure and a nonlinear minimization technique are used to cause the locus of points generated by a transfer function to resemble the locus of points obtained from frequency response measurements. Different transfer functions can be tried until a satisfactory empirical transfer function of the system is found. To illustrate the method, some examples and some results from a study of a set of data consisting of measurements of the inlet impedance of a single tube forced flow boiler with inserts are given. Author

N72-26971*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ENERGY IN THE ENVIRONMENT AND THE SECOND LAW OF THERMODYNAMICS

Robert F. Mueller May 1972 9 p refs Submitted for publication
(NASA-TM-X-65912; X-644-72-130) Avail: NTIS HC $3.00 CSCL 20M

The relationship between the consumption of energy by technological cultures and the second law of thermodynamics is discussed. The analysis is based on a description of the operation of a mechanical device which consumes energy. It is concluded that the flow of energy in manifold spontaneous conditions, which play a vital role in the operation of any technological process, remove most of the energy flow path from the control of the operator. It is stated that the increased efficiency of a process can benefit the environment only as much as this efficiency enables the total energy input to be reduced for a given level of production and increasing efficiency cannot meet the problems of an increased rate of energy utilization. Author

N72-26972# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Heterogene Stroemungen.

MASS TRANSFER INVESTIGATIONS ON A FLAT HYDROCARBON FILM (n-HEXANE) IN TANGENTIAL AIR FLOW [UNTERSUCHUNG DES STOFFUEBERGANGS AN EINEM EBENEN KOHLENWASSERSTOFFILM (n-HEXAN) BEI TANGENTIALER ANSTROEMUNG]

Dieter Junghans and Wolf Splettstoesser 1971 40 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft
(DLR-FB-71-106) Avail: NTIS HC $4.00; DFVLR, Porz: 11 DM

The test layout and the test procedures for the determination of the evaporating mass rates of a flat n-hexane film maintained in an air flow are described. For the case of a laminar boundary layer upon liquid film, the air flow temperature and the film length are determined. The results are presented as diagrams and compared with the results from simple computation methods. The resulting Sherwood numbers are compared with those of benzene. Author (ESRO)

N72-26973# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

DIAGRAMS FOR COMPUTING THE RADIATION OF AXISYMMETRIC SURFACES (PROPULSIVE NOZZLES)

Jean-Joseph Bernard (CNRS, Meudon, France) and Jeanne Genot 1971 37 p refs In FRENCH; ENGLISH summary
(ONERA-NT-185) Avail: NTIS HC $4.00

The exchange functions of radiative heat transfer of internal and external walls are calculated between annular sections of axisymmetric surfaces roughly representing propulsive nozzles. Their connection with the rocket body and their aperture towards the ambient surroundings are evaluated. The computation of these exchange functions for internal and external walls, outlines two universal functions of three geometrical parameters linked to the meridian shape and to the section position. The numerical values of these functions are given, and the expressions of the exchange functions directly usable by computers or simulators are also given for particular nozzle geometry. Author (ESRO)

N72-26974# Naval Postgraduate School, Monterey, Calif.

NATURAL CONVECTION HEAT TRANSFER FROM A HORIZONTAL DISK IN A CYLINDRICAL ENCLOSURE M.S. Thesis

Duane Stewart Duncan, Jr. Dec. 1971 59 p refs
(AD-738911) Avail: NTIS CSCL 20/13

In the report the author discusses natural convection in water from a horizontal mirror finished disk, heated in the center and surrounded by a cylindrical enclosure. The test section was designed to insure a one dimensional heat flux. Measurements were taken with power inputs varying from 25 to 5 watts. Fluid depth had a definite effect on the heat transfer. An apparent maximum value existed at a ratio of enclosure radius to fluid depth of one. Comparison of the data with existing correlations however, was poor which led to the questioning of the validity of the assummed one dimensional heat flux. Use of a finite element computer program demonstrated that two dimensional effects were important. Subsequent modification of the heat transfer coefficient to account for this variation gave a correlation more in agreement with those existing in the literature. Author (GRA)

N72-26975# Naval Ammunition Depot, Crane, Ind.

IMPACT INITIATION SENSITIVITY OF REACTIVE MATERIALS: A SELECTIVE BIBLIOGRAPHY INCLUDING ABSTRACTS

Charles A. Lipscomp Feb. 1972 51 p refs
(AD-738812; NAD-CR-RDTR-198) Avail: NTIS CSCL 19/1

The purpose of the report is to provide the research, development, design, and production of explosives, pyrotechnics, and propellants and an abstracted listing of reports and articles dealing with the general subject initiation sensitivities for those materials. Author (GRA)

N72-26976# Cornell Univ., Ithaca, N.Y. Dept. of Theoretical and Applied Mechanics.

MELTING OF A SLAB INITIALLY AT THE MELT TEMPERATURE

Yueb Fung Lee Mar. 1972 17 p refs
(Contract N00014-67-A-0077-0009)
(AD-739333; TR-10) Avail: NTIS CSCL 20/13

A simple analytic solution is derived for a slab, initially at the melt temperature, melting under surface heat-inputs prescribed in the form of any polynomial in time. The solutions for the position of solid-liquid interface and the temperature distribution of the melted liquid are obtained in series form, in which the successive coefficients are readily calculated. Author (GRA)

N72-26977# Cornell Univ., Ithaca, N.Y. Dept. of Theoretical and Applied Mechanics.

ON THE USE OF SUPERPOSITION IN THE APPROXIMATE SOLUTION OF HEAT CONDUCTION PROBLEMS

Bruno A. Boley Mar. 1972 26 p refs
(Contract N00014-67-A-0077-0009)
(AD-739334; TR-11) Avail: NTIS CSCL 20/13

The use of convolution integrals and of the method of images, applied to approximate basic solutions, is investigated. The value of these techniques in deriving approximate solution of heat conduction problems is discussed, and their accuracy, relative to both known exact solutions and other approximate ones, is assessed. Author (GRA)

N72-26383*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HEAT PIPES FOR SPACECRAFT TEMPERATURE CONTROL: THEIR USEFULNESS AND LIMITATIONS

S. Ollendorf and E. Stipandic *In its* 6th Aerospace Mech. Symp. Jun. 1972 p 33-41 refs (See N72-26377 17-15)
Avail: NTIS HC $3.00 CSCL 20M

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N72-26978*# California Univ., Los Angeles.

WORKSHOP ON DIMENSIONAL ANALYSIS FOR DESIGN, DEVELOPMENT, AND RESEARCH EXECUTIVES Summary Report

Richard Alan Goodman and William J. Abernathy Oct. 1971 60 p refs
(Contracts NSR-05-007-236-M1; N00014-69-C-0263)
(NASA-CR-127060) Avail: NTIS HC $5.00 CSCL 05A

The proceedings of a conference of research and development executives are presented. The purpose of the meeting was to develop an understanding of the conditions which are appropriate for the use of certain general management tools and those conditions which render these tools inappropriate. The verbatim statements of the participants are included to show the direction taken initially by the conference. Formal presentations of management techniques for research and development are developed. P.N.F.

N72-26979# Defence Standards Labs., Maribyrnong (Australia).

[MATERIALS SCIENCE AND PROCESSING, AND INSTRUMENTATION IN SUPPORT OF ARMED SERVICES] Annual Report, 1970 - 1971

1971 66 p refs Original contains color illustrations
Avail: NTIS HC $5.50

The activities of the Defense Standard Laboratories of Australia are presented. The laboratories evaluate and develop new weapons and other devices, suggest design changes which may be needed because of climate and terrain in possible operational areas, and serve as advisors and investigators during phases of development from prototype hardware to full scale development. The scope of the activities include: (1) paints, (2) polymers, (3) explosives, (4) pharmacology, (5) lasers, (6) corrosion, (7) textiles, (8) photoconductors, and (9) instrumentation techniques. P.N.F.

N72-26980# Committee on Interstate and Foreign Commerce (U. S. House).

SETTLEMENT OF LABOR-MANAGEMENT DISPUTES IN TRANSPORTATION, PART 1

Washington GPO 1971 422 p refs Hearings on H.R. 3595, H.R. 3596, H.R. 2357, H.R. 5347, H.R. 8385, H.R. 9088, H.R. 9989, H.J.Res. 364 (and all identical bills) before Comm. on Interstate and Foreign Com., 92d Congr., 1st Sess., 27-29 Jul.; 3-4 Aug.; 14-16, 21, 28-30 Sep. 1971
Avail: Subcomm. on Transportation and Aeron.

The findings and recommendations of the Subcommittee on Transportation and Aeronautics of the U.S. House of Representatives concerning settlement of labor-management disputes in the transportation industry are presented. The report is composed mainly of testimony of witnesses before the committee. The provisions of the bill to provide more effective means of protecting the public interest in national emergency disputes involving the transportation industry are included. P.N.F.

N72-26981# Committee on Interstate and Foreign Commerce (U. S. House).

SETTLEMENT OF LABOR-MANAGEMENT DISPUTES IN TRANSPORTATION, PART 2

Washington GPO 1971 367 p refs Hearings on H.R. 3595, H.R. 3596, H.R. 2357, H.R. 5347, H.R. 8385, H.R. 9088, H.R. 9989, H.J.Res. 364 (and all identical bills) before Comm. on Interstate and Foreign Com., 92d Congr., 1st Sess., 27-29 Jul.; 3-4 Aug.; 14-16, 21, 28-30 Sep. 1971
Avail: Subcomm. on Transportation and Aeron.

The findings and recommendations of the Subcommittee on Transportation and Aeronautics of the U.S. House of Representatives concerning legislation for settlement of labor-management disputes in the transportation industry are presented. Summaries of legislative proposals are discussed. The testimonies of representatives of various industries are included. Analyses of government and industry efforts to reach agreements on the settlement of labor strikes are examined. P.N.F.

N72-26982# Committee on Science and Astronautics (U. S. House).

NATIONAL BUREAU OF STANDARDS OVERSIGHT HEARINGS

Washington GPO 1971 390 p refs Hearing before Comm. on Sci. and Astronaut., 92d Congr., 1st Sess., No. 12; 16, 21-23, and 28 Sep. 1971
Avail: Subcomm. on Sci., Res., and Develop.

The hearings on the National Bureau of Standards organization and functions before the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics of the U.S. House of Representatives are presented. Verbatim testimonies of several witnesses consitute the major part of the report. The witnesses discussed the cooperation of the Bureau of Standards with other government agencies, research and development projects, test equipment, and economic requirements to continue operations. P.N.F.

N72-26983# Environmental Protection Agency, Washington, D.C.

EPA'S NOISE ABATEMENT PROGRAM

Alvin F. Meyer, Jr. 1971 11 p Presented at the 2d Natl. Meeting of the Natl. Organ. to Insure a Sound Controlled Environment, 19 May 1971

Avail: NTIS HC $3.00

The activities of the Environmental Protection Agency noise abatement program are presented. The prevalent sources of noise in urban environments are described. The efforts of Federal, state, and local governments to control noise levels are discussed. The major provisions of the 1971 Noise Control Act and the noise pollution section of the Clean Air Act are included. P.N.F.

N72-26984# Alpha Inst., Huntsville, Ala.

PATENT SURVEY: SEARCH OF US GOVERNMENT-OWNED PATENTS

David Kiesselbach 2 Aug. 1971 216 p refs Sponsored by Dept. of Commerce

Avail: NTIS HC $13.00

A survey of the patents at the NASA Marshall Space Flight Center is presented. The objectives of the patent survey project are: (1) locate Government-owned patents resulting from Government-funded research and development, (2) review the status of the patents as to their applicability and availability for licensing, (3) use this information as a basis for specific product application studies, and (4) establishment of new enterprises to create employment opportunities. Detailed descriptions of 168 patents are included with an evaluation as to direct product application. P.N.F.

N72-26985# Commission of Outdoor Recreation, Richmond, Va.

HELIPORT FOR THE DISTRICT OF COLUMBIA

Washington GPO 1971 73 p refs Hearing on H.R. 9723 before Comm. on Public Works, 92d Congr., 1st Sess., 23 Sep. 1971

Avail: Subcomm. on Public Bldgs. and Grounds

The hearing concerning a heliport for the District of Columbia before the Subcommittee on Public Buildings and Grounds of the Committee for Public Works of the U.S. House of Representatives is presented. The statements of various witnesses concerning the need for increased helicopter facilities constitute the bulk of the report. The advantages of a heliport are discussed from various points of view. The economics and operating requirements of the installation are examined. P.N.F.

N72-26986# Committee on Armed Services (U. S. House).

CUBAN PLANE INCIDENT AT NEW ORLEANS

Washington GPO 3 Jan. 1972 14 p ref Report presented to the Comm. on Armed Serv., 92d Congr., 1st Sess., 3 Jan. 1972

Avail: Armed Serv. Investigating Subcomm.

A Congressional investigation into the penetration of United States Defenses by a Cuban aircraft on 26 October 1971 is reported. The investigation was initiated following the arrival of a transport aircraft on a flight from Havana, Cuba to New Orleans, Louisiana, with no detection or warning prior to arrival at the New Orleans airport. The lack of military security which made this flight possible is examined and causes for the defects in the security system are analyzed. Recommendations are made to prevent future occurrences. P.N.F.

N72-26987# Committee on Armed Services (U. S. House).

CUBAN PLANE INCIDENT AT NEW ORLEANS

Washington GPO 1972 125 p Hearings before Comm. on Armed Serv., 92d Congr., 1st Sess., 9 and 17 Nov. and 9 Dec. 1971

Avail: Armed Serv. Investigating Subcomm.

The findings of a Congressional hearing concerning an undetected flight of a Russian built AN-24 aircraft from Havana, Cuba to New Orleans, Louisiana are presented. The flight occurred on October 26, 1971 and exposed a deficiency in air traffic control and military surveillance and interception procedures. The circumstances surrounding the incident and the dereliction of the organizations involved are discussed. The verbatim testimonies of many witnesses compose the major part of the report. P.N.F.

N72-26988*# National Aeronautics and Space Administration, Washington, D.C.

STATEMENT OF GEORGE M. LOW, DEPUTY ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, BEFORE THE SUBCOMMITTEE ON INTERNATIONAL COOPERATION IN SCIENCE AND SPACE, COMMITTEE ON SCIENCE AND ASTRONAUTICS, HOUSE OF REPRESENTATIVES: NEWS RELEASE

16 Jun. 1972 15 p refs Statement delivered 15 Jun. 1972

(NASA-TM-X-68462) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 05D

A statement by NASA Deputy Administrator George M. Low pertaining to the Moscow Summit agreement on cooperation in space between the United States and the Soviet Union is presented. The statement, delivered June 15 before the House Subcommittee on International Cooperation in Science and Space, includes: (1) a summary of the agreement; (2) a review of events leading to its adoption; (3) description of the rendezvous and docking test mission; and (4) the benefits to be achieved. Author

N72-26989# Committee on Armed Services (U. S. Senate).

FISCAL YEAR 1973 AUTHORIZATION FOR MILITARY PROCUREMENT, RESEARCH AND DEVELOPMENT, CONSTRUCTION AUTHORIZATION FOR THE SAFEGUARD ABM, AND ACTIVE DUTY AND SELECTED RESERVE STRENGTHS. PART 6: BOMBER DEFENSE, TACTICAL AIR POWER, AND F-14

Washington GPO 1972 853 p refs Hearings on S. 3108 before Comm. on Armed Services, 92d Congr., 20 Sess., 1, 7-10, 1-7, and 28-30 Mar. and 17-19 Apr. 1972

Avail: Comm. on Armed Services

The hearings before the Committee on Armed Forces of the United States Senate for determining the fiscal year 1973 authorization for the Armed Forces are presented. The purpose of the hearings was to authorize appropriations for the procurement of military equipment and weapon systems. Funds for research and development projects are requested and justified. The personnel strength of each branch of the military is established for the given time period. The report consists primarily of questions and answers between committee members and witnesses for the military. P.N.F.

N72-26990# National Academy of Sciences-National Research Council, Washington, D.C. Highway Research Board.

AUTOMATION SYSTEMS FOR HIGHWAY ORGANIZATIONS Special Report 128

1972 133 p refs Proc. of the Western Summer Meeting, Austin, Tex., 16-18 Aug. 1971; sponsored by the Highway Res. Board and cosponsored by the Tex. Highway Dept. and Tex. Univ. Coll. of Eng.

(LC-72-80756; ISBN-0-309-01997-4) Avail: NTIS HC $8.75

The proceedings of the Highway Research Board conference held at Austin, Texas on August 16 through 18, 1971 are presented. The purpose of the conference was to stimulate interest in and advance the use of computer-based automation systems for highway organizations. Specific subjects presented were: (1) automation for making adminstrative and managerial decisions, (2) computer applications for design and construction of roads and related equipment, (3) development of administrative management information system, (4) automation techniques for traffic operations and highway maintenance, and (5) computer procedures for transportation planning and data collection. Author

N72-26991# Organization for Economic Co-Operation and Development, Paris (France).

SPECIFICATION FOR MAGNETIC TAPE TRANSFER OF BIBLIOGRAPHIC INFORMATION IN THE INTERNATIONAL ROAD RESEARCH DOCUMENTATION SCHEME Road Research Programme

Jan. 1972 51 p

Avail: NTIS HC $4.75

Information on the computer capabilities and usage of members of the International Road Research Documentation scheme (IRRD) is given, together with a procedure for the exchange of information using magnetic tapes. The format and structure of the tapes are detailed. ESRO

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N72-26992# Army Foreign Science and Technology Center, Charlottesville, Va.

TECHNOLOGY AND ARMAMENT, NO. 7, JULY 1971

3 Jan. 1972 168 p Transl. into ENGLISH from Tekh. i Vooruz Henie (Moscow), no. 7, Jul. 1971
(AD-738777; FSTC-HT-23-1239-72) Avail: NTIS CSCL 15/3

Contents: Military training and service; The long-distance ocean fleet; Labor in Military repair; Machine tool building; Marine engineering; Ordnance; Mechanical engineering; Digital computers; Engines and motor vehicles; Water reservoirs; Hydraulic systems; Radiation control; Radio stations; Battery recharging; Technical creativity; Reports from inventors; Literature. GRA

N72-26876 Honeywell, Inc., Hopkins, Minn. Government and Aeronautical Products Div.

THE EFFECT OF THE FIN-OPENING SHOCK ENVIRONMENT ON GUIDED MODULAR DISPENSER WEAPONS

K. D. Denton and K. A. Herzing *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 3 Jan. 1972 p 159-165 refs (See N72-26860 17-30)
Avail: Shock and Vibration Information Center, Naval Research Labs., Washington, D. C.: HC $40.00 per set

N72-26899 Southwest Research Inst., San Antonio, Tex.

BLAST FIELDS ABOUT ROCKETS AND RECOILLESS RIFLES

W. E. Baker, P. S. Westine, and R. L. Bessey *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 42, Pt. 4 Jan. 1972 p 185-199 refs (See N72-26882 17-32)
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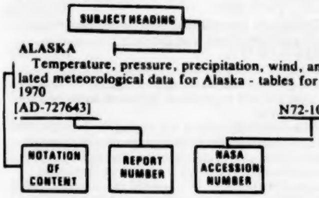
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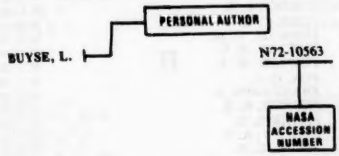

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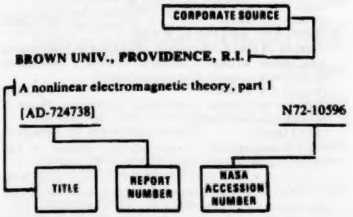

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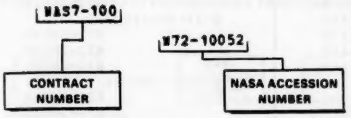

Listings in this index are arranged alphanumerically by contract number. Under each contract number, the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

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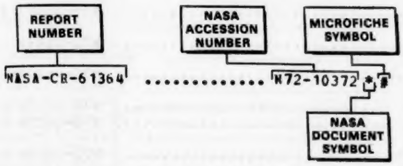

Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche. A plus sign (+) indicates a document that can not be microfiched but for which one-to-one facsimile is available.

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By DONALD H. BUCKLEY

This publication reviews, in the context of the vacuum environment, the adhesion theory; it also discusses the various classes of materials—metals, carbons, inorganic crystalline solids, and plastics—in sliding contact in vacuum. With metals the influence of various properties is related to friction and wear. These properties include orientation, crystal structure, recrystallization, texturing, ductile-brittle transitions, and order-disorder reactions. The effect of adsorbed gases from fractions of a monolayer to multilayer coverage is shown to influence friction with the particular nature of the adsorbing species having a marked effect. Conventional lubricants undergo a change in their lubrication behavior as a result of the degassing that occurs in vacuum. Various solid-film lubricants and methods for their application are described. *Paperbound.* 110 pp. For sale by the National Technical Information Service, Springfield, Va. 22151, for $3.00.

Apollo 15: Preliminary Science Report (NASA SP-289)

This publication contains the early scientific results from the fourth manned lunar landing, carried out in August 1971 by astronauts Worden, Scott, and Irwin. The results reported in this volume represent work performed by the assigned scientific investigators in the months immediately following the mission. *Paperbound.* 580 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $8.00.

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